

AD-A088 341

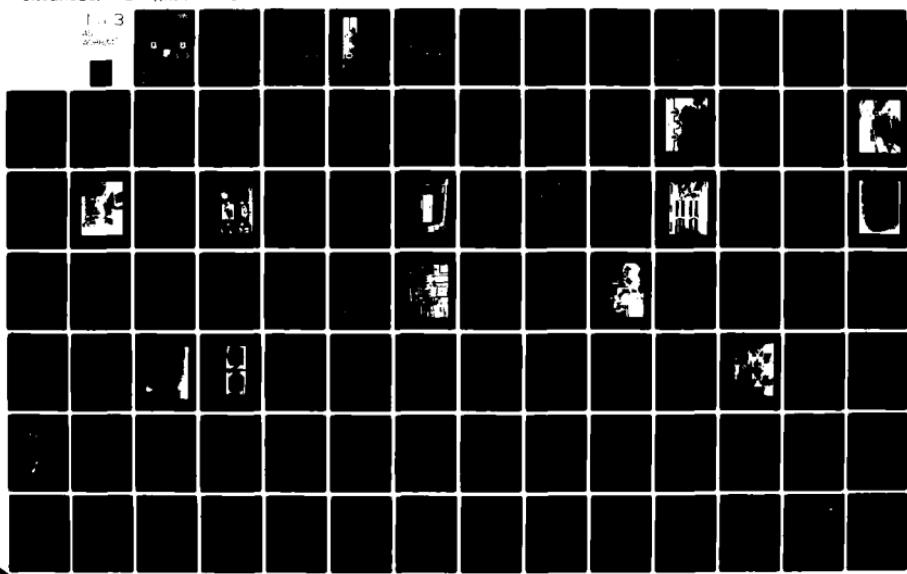
HOME AIR DEVELOPMENT CENTER GRIFFISS AFB NY  
INDUSTRY LOOKS AT RADC - 1980. VOLUME III.(U)  
1980

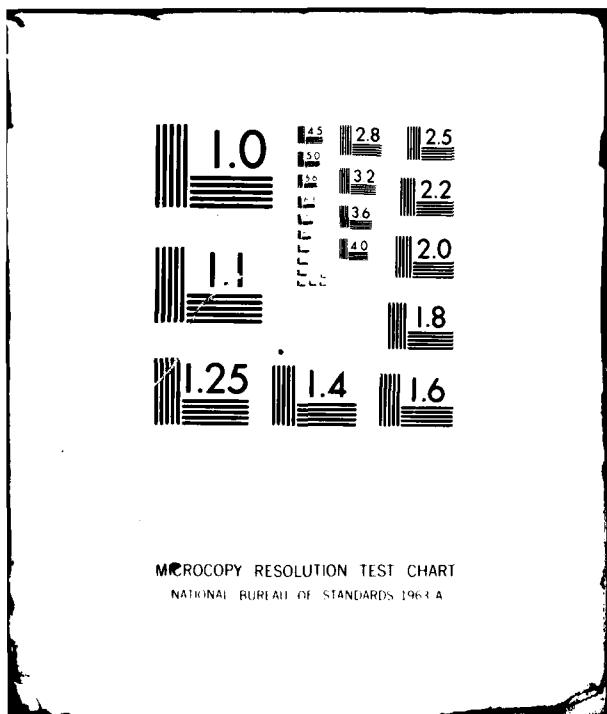
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RADC-TR-80-195-VOL-3

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RADC-TR-80-195, Vol III (of three)  
In-House Report  
3-4 June 1980

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LEVEL III

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ROME AIR DEVELOPMENT CENTER  
(RADC)

INDUSTRY LOOKS AT RADC - 1980



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ROME AIR DEVELOPMENT CENTER  
Air Force Systems Command  
Griffiss Air Force Base, New York 13441

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RADC-TR-80-195, Volume III (of three) has been reviewed and is approved for publication.

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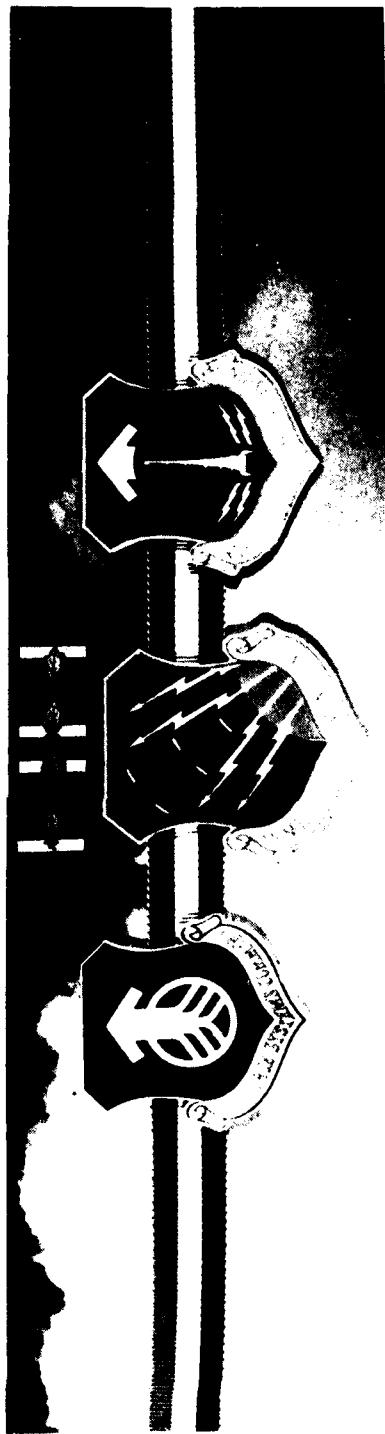
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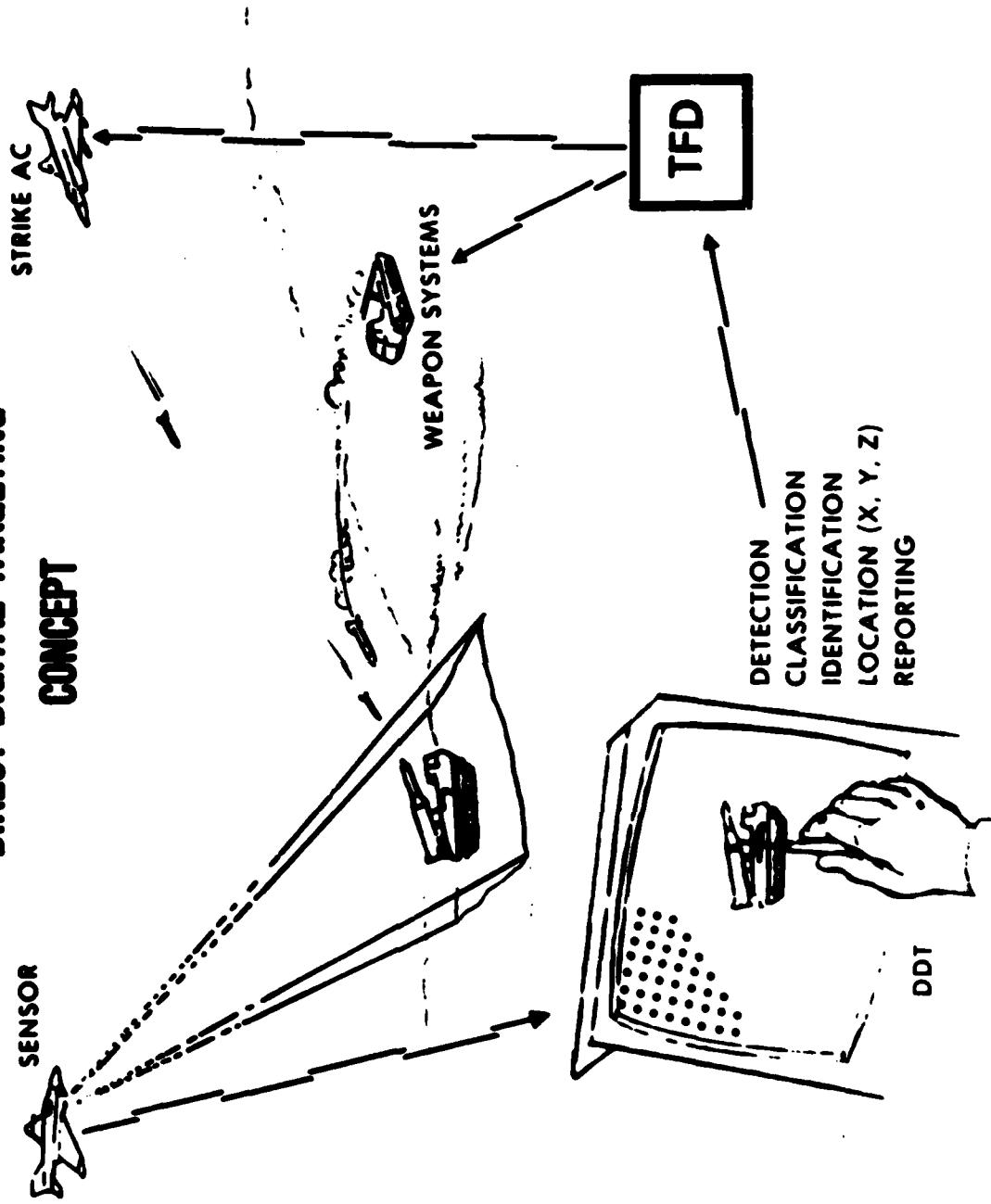
## DIRECT DIGITAL TARGETING

PRESENTED BY: MAJ. A. C. CRANE, JR.

RADC/IRR

ACCESSION for	White Section	Black Section
NTIS	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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**DIRECT DIGITAL TARGETING  
CONCEPT**



### **DIRECT DIGITAL TARGETING**

**PROGRAM GOALS:** DEVELOP AND DEMONSTRATE A CAPABILITY TO PERFORM AUTO AND SEMI-AUTO TARGET CUEING, DETECTION, IDENTIFICATION, PRECISE LOCATION AND REPORTING FROM NEAR-REAL-TIME DIGITAL IMAGERY SENSORS.

**TECHNICAL AREAS:**

- DIGITAL IMAGE EXPLOITATION
- MASS STORAGE AND RETRIEVAL
- PRECISE TARGET LOCATION

**PROGRAMS:**

**FUNDING FY81 - FY86**  
**(In Millions)**

<b>6.2</b>	<b>\$ 4.43</b>
<b>6.3</b>	<b>\$19.85</b>

TECH BASE FOR DIRECT DIGITAL TARGETING (DDT)

**OBJECTIVE:** PULL EXISTING TECH BASE TOGETHER AND FOCUS ON THE CAPABILITY TO ACCOMPLISH NEAR REAL TIME DIGITAL IMAGERY EXPLOITATION IN 5 MIN WITH < 50 FT TARGET LOCATION ACCURACY.

**RATIONALE:** A USAF CAPABILITY TO PERFORM TARGET DETECTION, IDENTIFICATION, PRECISE LOCATION, AND REPORTING IN A NEAR-REAL-TIME OPERATIONAL SCENARIO DOES NOT EXIST.

**PAYOUT:**

- TECHNOLOGY TO DETECT, ID, LOCATE, REPORT ON TARGETS IN NRT IN ALL WEATHER.
- PROVIDE TECHNOLOGY FOR A COMMON SYSTEM, (I.E., NOT SENSOR/MISSION UNIQUE GROUND EXPLOITATION SYSTEMS) TO SUPPORT TACTICAL AND STRATEGIC FORCES.

## TECH BASE FOR DIRECT DIGITAL TARGETING

### TECHNICAL APPROACH:

#### INTEGRATE DEVELOPMENTS IN

- PATTERN RECOGNITION
- TARGET DETECTION/IDENTIFICATION
- MASS STORAGE & RETRIEVAL
- PRECISE TARGET LOCATION
- NRT REPORTING
- C<sup>3</sup>I INTERFACE

#### LABS/FIELD DEMONSTRATION

- MODULAR
- USER INTERACTION
- EXPLOITATION OF ALL DIGITAL IMAGERY SENSORS

#### ALTERNATIVES

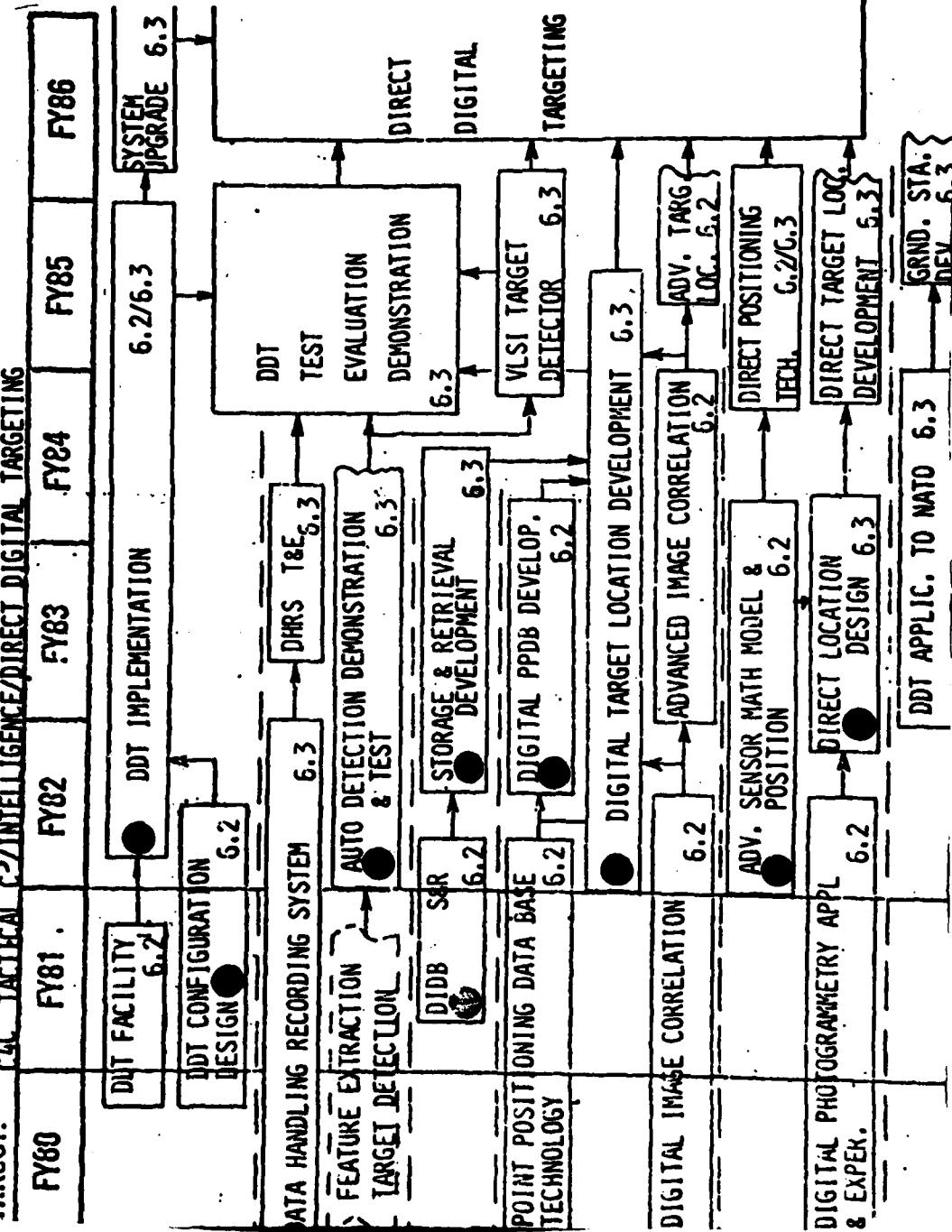
- CONTINUE WITH CURRENT SYSTEM TO DEVELOP UNIQUE END ITEMS
- SURVIVABILITY (REDUNDANCY), MAINTENANCE, TRAINING PROBLEMS.

#### WHY DDT

- THE COMMON SYSTEM APPROACH PROVIDES A MORE COST EFFECTIVE,
- RESPONSIVE AND SUPPORTABLE OPERATIONAL CAPABILITY.

ASIC TPG 1 C3

THRUST: C4C TACTICAL C3/INTELLIGENCE/DIRECT DIGITAL TARGETING



## **DIRECT DIGITAL TARGETING**

**BLOCK TITLE:** DDT IMPLEMENTATION

**OBJECTIVE:** PROVIDE SUITABLE ENVIRONMENT AND FUNCTIONAL ARCHITECTURE TO PERMIT DEVELOPMENT AND DEMONSTRATION OF DDT AND C<sup>3</sup> NODE INTERFACES AND INTEROPERABILITY.

### **TECHNICAL APPROACH:**

- EMPLOY MODULAR APPROACH
- START WITH AVAILABLE DIGITAL TECHNOLOGY
- INCORPORATE TECHNICAL IMPROVEMENTS
- PERFORM FUNCTIONAL TESTS USING ALL SOURCE IMAGE INPUTS

**PAYOFF:** HIGH

**DIRECT DIGITAL TARGETING**

**BLOCK TITLE: DDT CONFIGURATION DESIGN**

**OBJECTIVE:** DEFINE DDT FLOW PROCESSES AND FUNCTIONS; DEVELOP A CONFIGURATION CONCEPT TO PERMIT DEMONSTRATION, SIMULATION AND/OR EVALUATION OF THE USE OF NRT DIGITAL IMAGE DATA FROM THE SOURCE TO THE BATTLE COMMANDER.

**TECHNICAL APPROACH:** - PERFORM SCENARIO ANALYSES - NATIONAL AND TACTICAL SENSORS  
- DEVELOP OVERALL PROCESS FLOWS  
- TIMING OF OPERATIONS ANALYSIS  
- ESTABLISH DEVELOPMENT NEEDS

**PAYOUT:** HIGH - WILL PERMIT ESTABLISHMENT OF WORK FUNCTIONS REFLECTING BEST ANALYSES OF USER REQUIREMENTS.

**DIRECT DIGITAL TARGETING**

**BLOCK THREE: AUTOMATIC DETECTION DEMONSTRATION AND TEST**

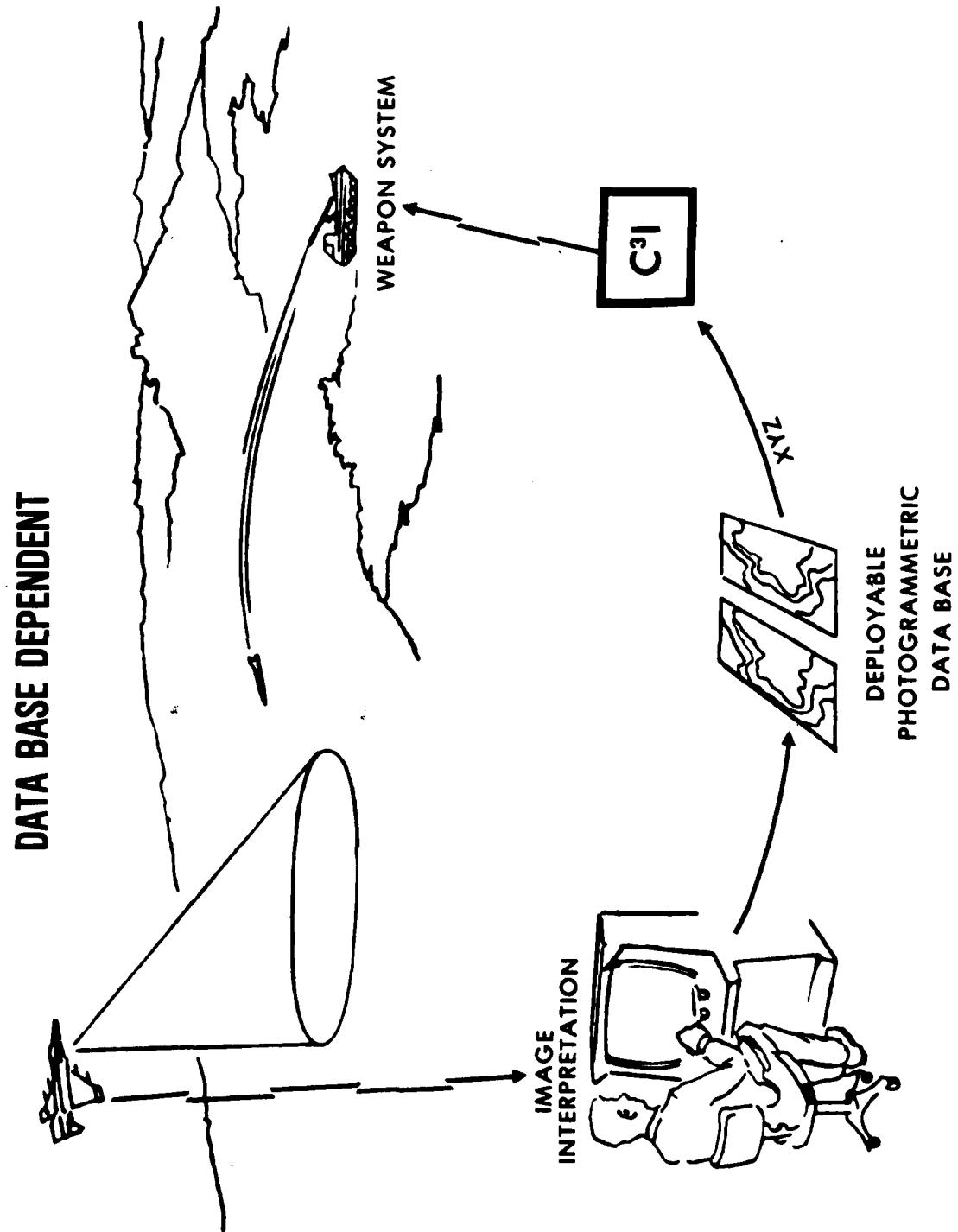
**OBJECTIVE:** DEVELOP AND TEST TECHNIQUES AND EQUIPMENT TO ALLOW REAL TIME  
TARGET DETECTION WITHIN MINUTES OF OVERFLIGHT, FROM ALL SOURCE  
DIGITAL IMAGE DATA.

**TECHNICAL APPROACH:**

- DEVELOP AUTOMATIC TARGET DETECTION ALGORITHMS
- DEVELOP MANAGEMENT TECHNIQUES
- TEST AND IMPLEMENT
- FABRICATE CONSOLE - DEMONSTRATE R-T TARGET DETECTION
- WORK IN DYNAMIC ENVIRONMENT - MULTIPLE SOURCE INPUTS

**PAYOUT:**

- SENSOR INDEPENDENT R-T EXPLOITATION
- SUPPORT MOBILE TARGET STRIKES



**DIRECT DIGITAL TARGETING**

**BLOCK TITLE:** DIGITAL IMAGE DATA BASE STORAGE AND RETRIEVAL (DIDB S&R)

**OBJECTIVE:**

- ESTABLISH S&R DEVICE DESIGN SPECS
- DEVELOP S&R ALGORITHMS

**TECHNICAL APPROACH:**

- DETERMINE AND EVALUATE DATA FLOWS
- TRADE-OFF ANALYSES
- SELECT OPTIMUM PARAMETERS
- INCLUDE OPTICAL DISK AND HIGH DENSITY MAGNETIC TAPE

**PAY OFF:** HIGH - EFFORT WILL LOWER RISK OF S&R DEVICE DEVELOPMENT

**DIRECT DIGITAL TARGETING**

<b>BLOCK TITLE:</b>	<b>STORAGE AND RETRIEVAL DEVELOPMENT</b>	
<b>OBJECTIVE:</b>	PROVIDE A MASS STORAGE AND RETRIEVAL MEDIUM TO ACCOMMODATE A DIGITAL IMAGE DATA BASE FOR THE TARGET LOCATION FUNCTION.	
<b>TECHNICAL APPROACH:</b>	PERFORM DETAIL DESIGN, FABRICATE AND INTEGRATE INTO THE DDT SYSTEM.	
<b>PAY OFF:</b>	HIGH. DDT OBJECTIVES DEPEND UPON THE AVAILABILITY OF HIGH DENSITY RAPID AND RANDOM ACCESS, RELIABLE DATA STORAGE AND RETRIEVAL MECHANISMS.	

**DIRECT DIGITAL TARGETTING**

**BLOCK TITLE: DIGITAL POINT POSITIONING DATA BASE (PPDB) DEVELOPMENT**

**OBJECTIVE:** DEVELOP AN EXPERIMENTAL ALL DIGITAL POINT POSITIONING DATA BASE TO PROVIDE NRT PRECISE TARGET LOCATIONS FROM MULTI SENSOR RECCE IMAGERY.

**TECHNICAL APPROACH:**

- CONVERT WORKING SEGMENTS OF AVAILABLE HARDCOPY IMAGERY
- DEFINE DIGITAL FORMAT AND GENERATE DIGITAL PPDB
- STORE ON MASS STORAGE DEVICE
- RETRIEVE AND EXPLOIT - PERFORM EXPERIMENTS
- GENERATE SPECS FOR OPERATIONAL DIGITAL PPDB

**PAYOUT:**

- RAPID TARGET LOCATION OPERATIONS
- EXPERIMENTALLY ESTABLISHED DIGITAL PPDB REQUIREMENTS
- CONFIDENCE IN DESIGN PARAMETERS

**DIRECT DIGITAL TARGETING**

**BLOCK TITLE:** DIGITAL TARGET LOCATION DEVELOPMENT

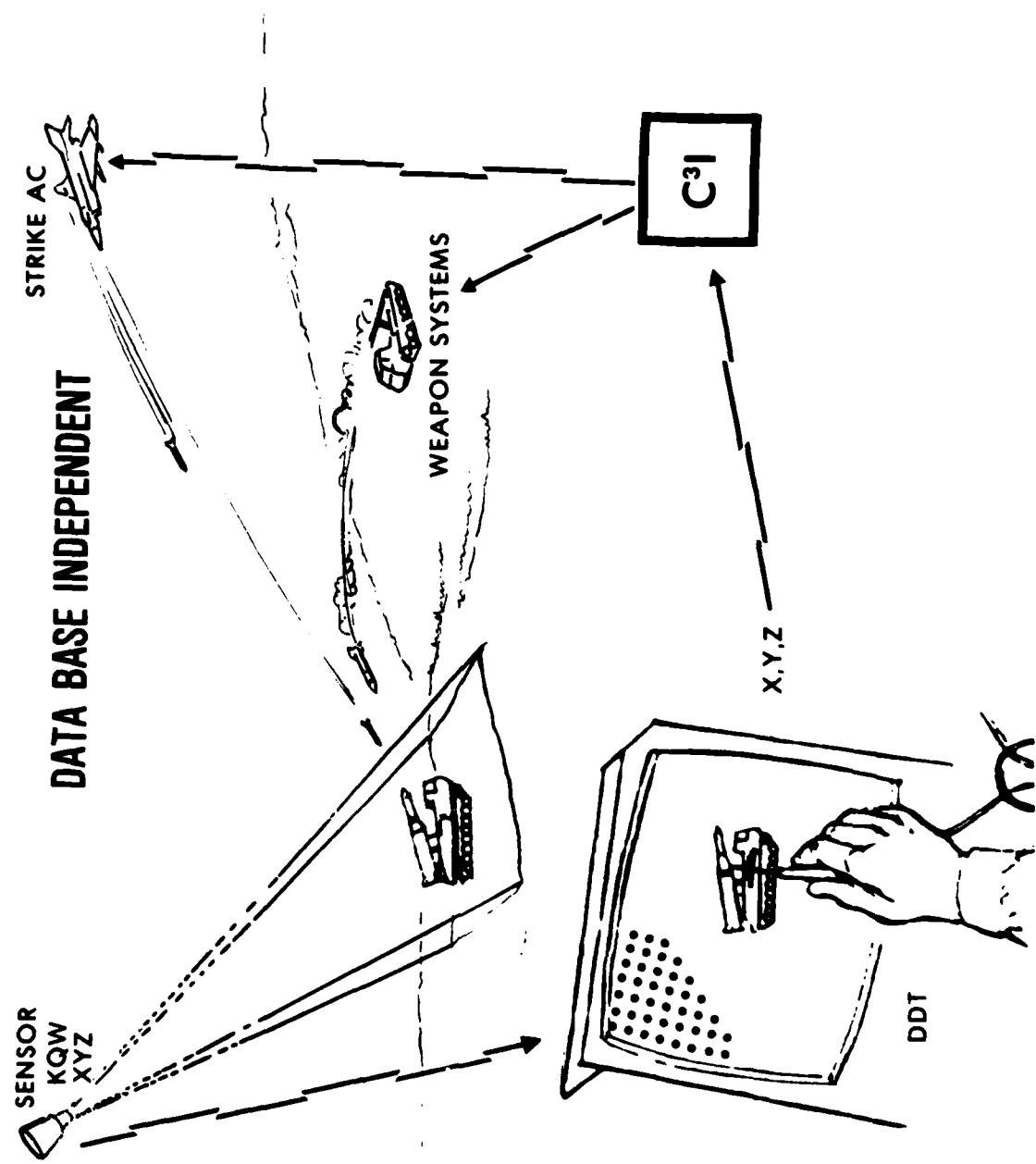
**OBJECTIVE:** TO PROVIDE THE DESIGN, FABRICATION, AND TEST AND EVALUATION IN THE DDT ENVIRONMENT OF A CAPABILITY TO DERIVE PRECISE TARGET LOCATION INFORMATION IN NEAR-REAL-TIME.

**TECHNICAL APPROACH:**

- EMPLOY MODULAR APPROACH
- PERFORM SYSTEM DESIGN THAT INCLUDES DIGITAL IMAGE VIEWING, MENSURATION, POINT TRANSFER, PPDB STORAGE & RETRIEVAL
- FABRICATION OF SYSTEM
- TEST AND DEMONSTRATION

**PAY OFF:**

- HIGH. PROVIDES NRT PRECISE TARGET LOCATION CAPABILITY



<b>BLOCK TITLE:</b>	<b>DIRECT DIGITAL TARGETING</b>
<b>BLOCK TITLE:</b>	<b>ADVANCED SENSOR MATH MODEL AND POSITION</b>
<b>OBJECTIVE:</b>	<b>IN CONJUNCTION WITH THE APPROPRIATE PROGRAM OFFICES DETERMINE THE AVAILABILITY, USABILITY, ACCURACY OF SENSOR ATTITUDE AND POSITION INFORMATION OF ADVANCED DATA LINKED IMAGING SYSTEMS IN REAL-TIME.</b>
<b>TECHNICAL APPROACH:</b>	<ul style="list-style-type: none"> <li>- DEVELOP ADVANCED IMAGING SENSORS GEOMETRIC MATH MODEL (S)</li> <li>- PERFORM ERROR PROPAGATION ANALYSIS - ESTABLISH POINT POSITION ACCURACIES</li> <li>- PERFORM SCENARIO ANALYSES WITH SENSOR POSITION AND ATTITUDE DATA</li> </ul>
<b>PAY OFF:</b>	<b>HIGH</b>

**DIRECT DIGITAL TARGETING**

**BLOCK TITLE:** DIRECT LOCATION DESIGN

**OBJECTIVE:** TO DESIGN A POINT POSITIONING DATA BASE INDEPENDENT  
TARGET LOCATION CAPABILITY.

**TECHNICAL APPROACH:**

- BUILD ON ADV. SENSOR MATH MODEL AND POSITION STUDY
- BUILD ON DIGITAL SOFT COPY MENSURATION AND ANALYTICAL STUDIES
- DEVELOP DESIGN TO INTEGRATE TECHNOLOGIES
- DEVELOP SPECIFICATION FOR DIRECT TARGET LOCATION SYSTEM

**PAY OFF:**

- HIGH. WILL PROVIDE DIRECT TARGET LOCATION DESIGN PARAMETERS
- WILL REDUCE RISK OF FOLLOW-ON DEVELOPMENT

**DIRECT DIGITAL TARGETING**

**BLOCK TITLE:** DDT APPLICATIONS TO NATO

**OBJECTIVE:** TO PROVIDE NATO RELEASABLE TECHNOLOGY TO SATISFY THE REQUIREMENTS OF NAFAG SUBGROUP 6 IMAGERY INTELLIGENCE INITIATIVE TO DEVELOP A COMMON GROUND STATION TO SUPPORT NATO IMAGERY RECONNAISSANCE EXPLOITATION, TARGET LOCATION AND REPORTING.

**TECHNICAL APPROACH:** A LOW COST, MODULAR APPROACH THAT UTILIZES AVAILABLE DIGITAL TECHNOLOGY WILL BE UTILIZED. HARDWARE AND SOFTWARE TECHNOLOGY IMPROVEMENTS WILL BE INCORPORATED AS THEY BECOME AVAILABLE.

**PAY-OFF:** PROVIDE NATO WITH A COMMON TECHNOLOGY TO BE INCORPORATED INTO THE DESIGN AND PRODUCTION OF IMAGERY RECONNAISSANCE GROUND STATION. THIS WILL ASSURE SURVIVABILITY THROUGH FLEXIBILITY AND REDUNDANT CAPABILITIES IN TIME OF WAR.

DIRECT DIGITAL TARGETING  
KEY PEOPLE

PROGRAM MANAGER - MAJOR ALFRED C. CRANE, JR./IRRA/X7024

DDT IMPLEMENTATION - MR. KEITH A. BUTTERS/IRRA/X6270  
& CONFIGURATION DESIGN - MR. DONALD MOE/IRRA/X2476

AUTOMATIC DETECTION - MR. DONALD BUSH/IRRE/X3095  
DEMONSTRATION & TEST

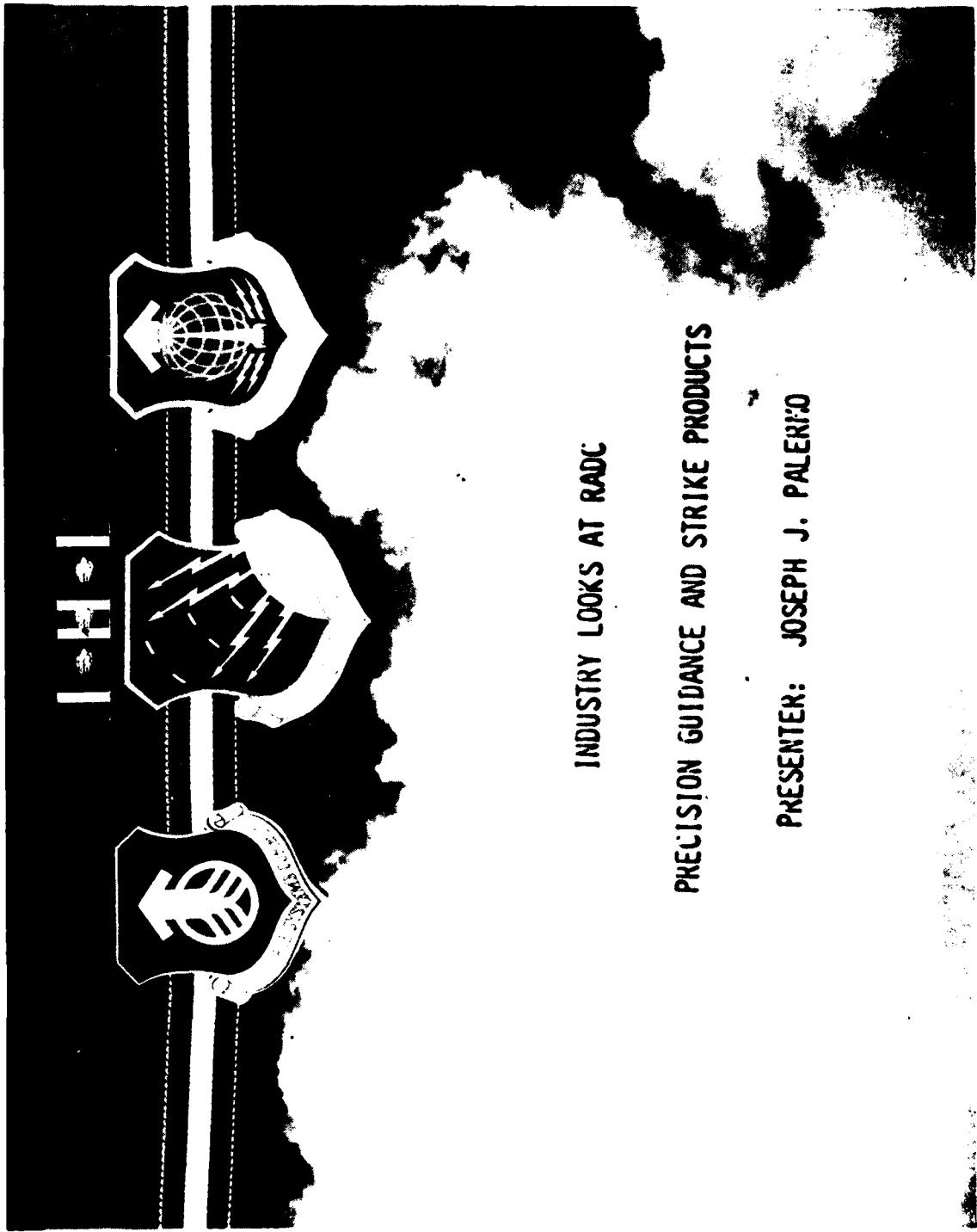
DIGITAL IMAGE DATA - MR. DONALD HALL/IRRA/X2476  
BASE STORAGE & RETRIEVAL

STORAGE & RETRIEVAL - MR. ALBERT JAMBERDINO/IRAP/X4581  
DEVELOPMENT

DIGITAL POINT POSITIONING - MR. DONALD HALL/IRRA/X2476  
DATA BASE (PPDB) DEVELOPMENT/  
DIGITAL TARGET LOCATION DEVELOPMENT

ADVANCED SENSOR MATH MODEL & POSITION - MR. DONALD MOE/IRRA/X2476

DDT APPLICATIONS TO NATO - MAJOR ALFRED C. CRANE, JR./IRRA/X7024



INDUSTRY LOOKS AT RADAR

PRECISION GUIDANCE AND STRIKE PRODUCTS

PRESENTER: JOSEPH J. PALEK

**TITLE: PRECISION GUIDANCE AND STRIKE PRODUCTS**

**PROGRAM GOALS:** DEVELOP AUTOMATED CAPABILITY TO PROCESS, STORE, MAINTAIN AND FORMAT EARTH SURFACE DATA (TERRAIN, CULTURE, HYDROGRAPHY, POLITICAL, ETC.) IN SUPPORT OF WEAPON SYSTEM REQUIREMENTS FOR PLANNING, NAV/GUIDANCE, SENSOR SIMULATION, PREDICTION AND TARGETTING.

**TECHNICAL AREAS:** • PHOTOGRAPHIC EXPLOITATION

• CARTOGRAPHIC EXPLOITATION

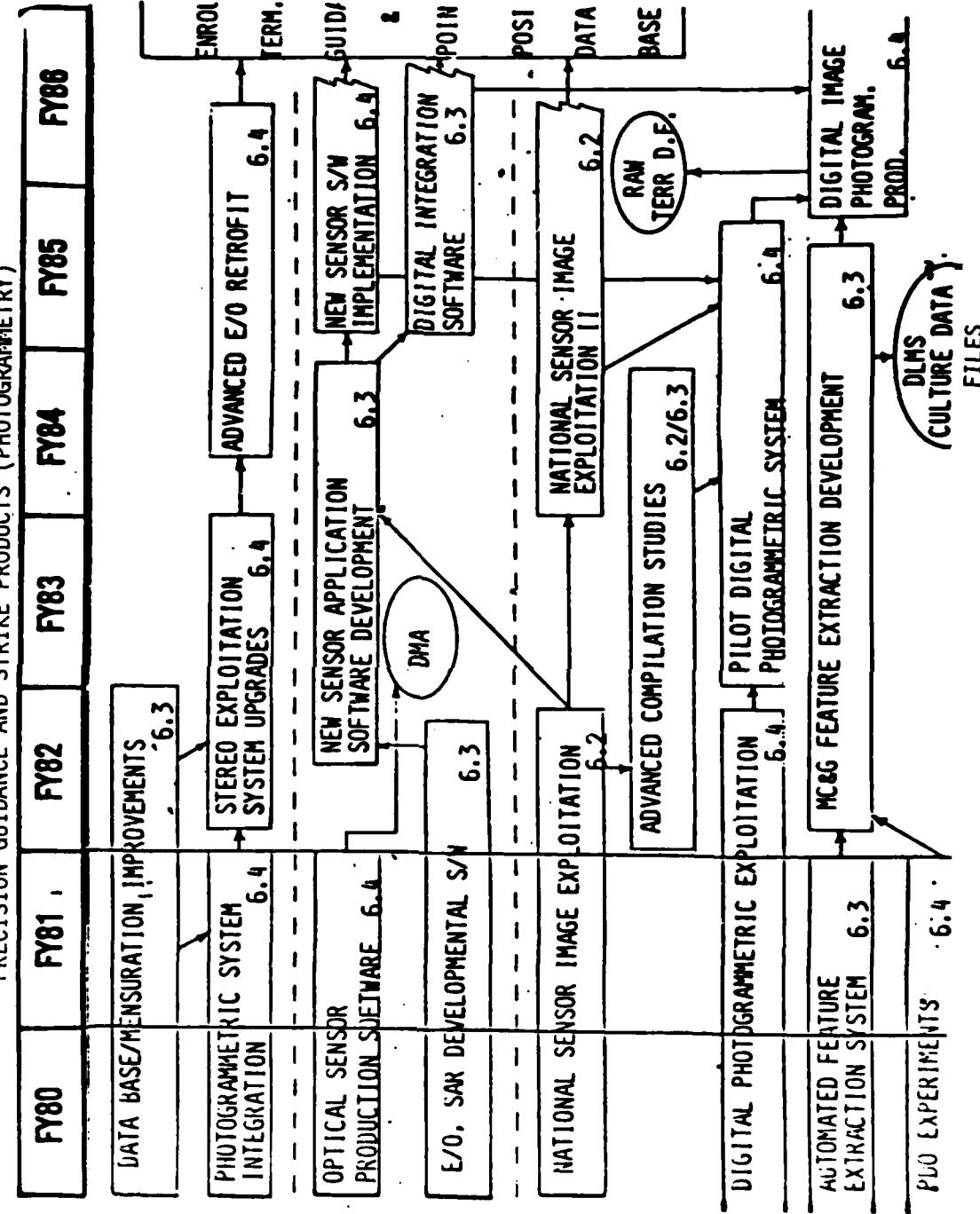
• SENSOR SCENE SYNTHESIS

• CARTO PROCESSING/DATA BASE/ARCHITECTURE

**FUNDING (APPROXIMATE): FY81 THROUGH FY86**

6.2	\$12,500
6.3	\$31,500
6.4	\$26,000

PRECISION GUIDANCE AND STRIKE PRODUCTS (PHOTOGRAVIMETRY)





**PRECISION GUIDANCE AND STRIKE PRODUCTS  
(PHOTOGRAPHY)**

**AREA TITLE:** HARD COPY PHOTOGRAPHY

**OBJECTIVE:** IMPROVEMENT OF IN-PLACE DMA PRODUCTION SYSTEMS VIA ENHANCEMENT OF MEASUREMENT AND PROCESSING ACCURACIES AND INCORPORATION OF ADDITIONAL SENSOR FORMATS.

**EFFORTS:**

FY81	TA3 P1 RETROFITS
FY82	AE IMPROVEMENTS

**POB:** RADC/IRNA/F. SCARANO 315-330-4203



**PRECISION GUIDANCE AND STRIKE PRODUCTS  
(PHOTOGRAMMETRY)**

**AREA TITLE: ANALYTICAL SOFTWARE**

**OBJECTIVE:** PROVIDE PROCESSING TO SUPPORT THE INTEGRATION OF PHOTOGRAMMETRIC EQUIPMENT INTO A MORE EFFICIENT PRODUCTION POSTURE. DEVELOP ANALYTICAL MODELS TO INCORPORATE ADDITIONAL SENSORS INTO THE PRODUCTION PROCESS.

**EFFORTS:** FY81      POIS OPTIMIZATION  
                    SAK COMPIRATION

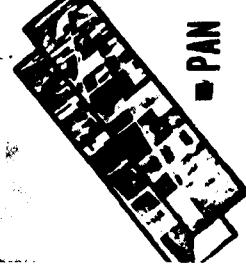
FY82      DISCONTINUOUS SURFACE FUNCTION ANALYSIS

**POL:** RADC/TKRA/F. SCARANO 315-530-4203

# CONVERSION - STEREO MAPPING

## STEREO DIGITIZING

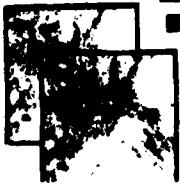
## SOURCE



■ PAN

■ FRAME

## SENSOR PARAMETERS

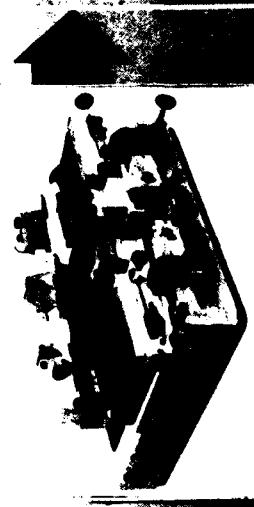


■ RADAR CODE  
■ PROFILES  
■ ELEVATION ARRAYS

■ CULTURE FEATURES  
■ CONTOURS



DATA FROM ILLUSTRATION SECTION



## STEREO COMPILER



## PHOTO DATA BASE

**PRECISION GUIDANCE AND STRIKE PRODUCTS**  
(PHOTOGRAMMETRY)

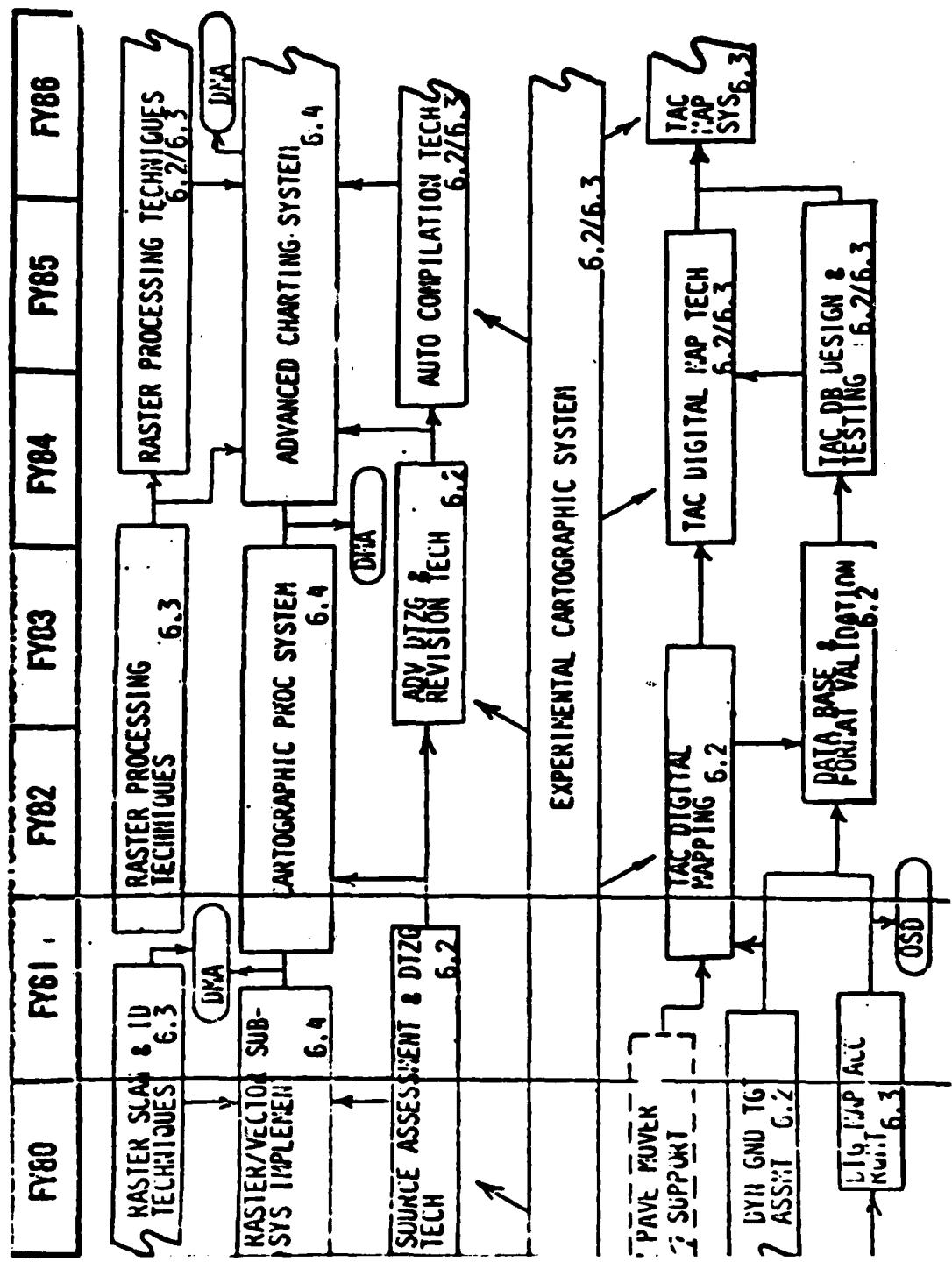
**AREA TITLE:** SOFTCOPY PHOTOGRAMMETRY  
**OBJECTIVE:** TECH BASE DEVELOPMENT IN DIGITAL STEREO IMAGE EXPLOITATION  
METHODS INCLUDING IMAGE VIEWING CONCEPTS, GEOMETRIC DEFINITIONS,  
AND IMAGE MATCHING PROCESSES IMPLEMENTATION OF PRODUCTION  
SOFTCOPY PHOTOGRAMMETRIC SYSTEMS.

**EFFORTS:** FY81 POINT INFORMATION MAINTENANCE SYSTEM  
FY82 UNIVERSAL RECTIFIER DEVELOPMENT.

**POC:** **POC:** **POC:**  
AERONAUTICAL PHOTO INTERPRETATION STATION  
DIGITAL STEREO COMPATOR/COMPLIER SYSTEM  
ADVANCED COMPIRATION STUDIES

**POC:** **POC:** **POC:**  
AER/IR&F. SC/IR&F. 315-330-4203

PRECISION GUIDED AND STRIKE PRODUCTS (CARTOGRAPHIC EXPLOITATION)





PRECISION GUIDANCE AND STRIKE PRODUCTS  
(CARTOGRAPHIC EXPLOITATION)

AREA TITLE:	CARTOGRAPHY		
OBJECTIVE:	PROVIDE SYSTEMS AND TECHNIQUES (HARDWARE AND SOFTWARE) TO: ASSESS CURRENT PRODUCTS AND SOURCES, DIGITALLY EXTRACT DATA FROM ANALOG CHART SOURCE. MANIPULATE AND PROCESS DIGITAL DATA FOR PRODUCT GENERATION AND/OR INCLUSION INTO THE DIA CARTOGRAPHIC DATA BASE.		
EFFORTS:	FY81	SCANNING CURSOR SOURCE ASSESSMENT SYSTEM RASTER PLOTTER IN COCKPIT DISPLAY ANALYSIS	
	FY82	AUTO CAK10 FEATURE I.D. RASTER SCAN CHARACTER RECOGNITION CARTO COMPILATION/REVISION SYSTEM RASTER AUTOCATED CAKTO SYSTEM	
POC:	WADC/INRP/J. PALEKHO 315-330-7060		

PRECISION GUIDANCE AND STRIKE PRODUCTS  
(CARTOGRAPHIC EXPLOITATION)

AREA TITLE: TACTICAL DIGITAL MAPPING

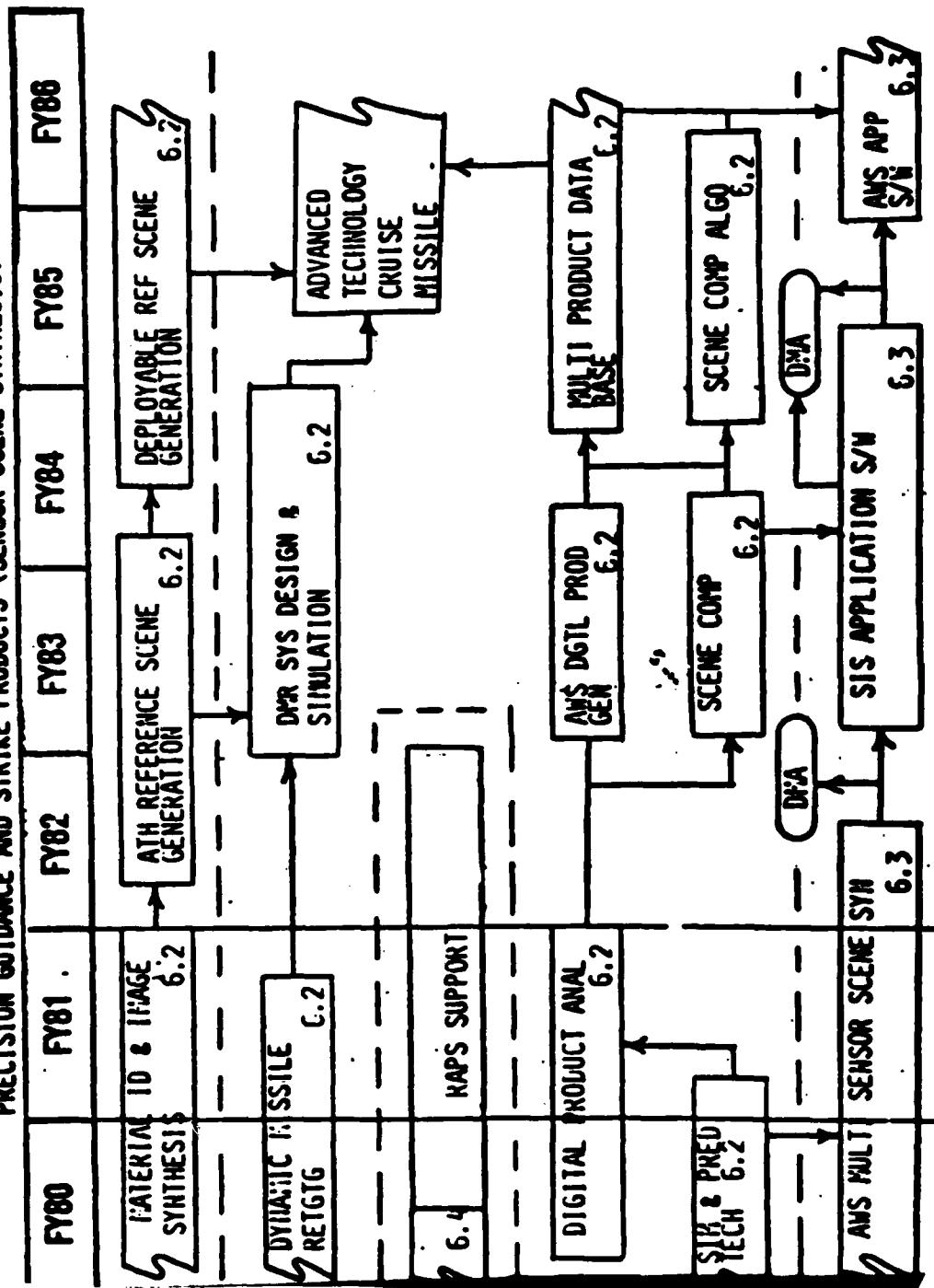
OBJECTIVE: IDENTIFY TERRAIN ANALYSIS DATA AND APPLICATIONS IN SUPPORT  
OF ADVANCED AF TACTICAL SENSOR/STRIKE AND CORRELATION  
FUSION ACTIVITIES.

DEVELOP METHODS TO DETERMINE EFFECTS OF DATA BASE CHANGES  
AND METHODS TO VALIDATE DATA BASE CONTENT AND ACCURACY  
FOR ADVANCED WEAPON SYSTEMS.

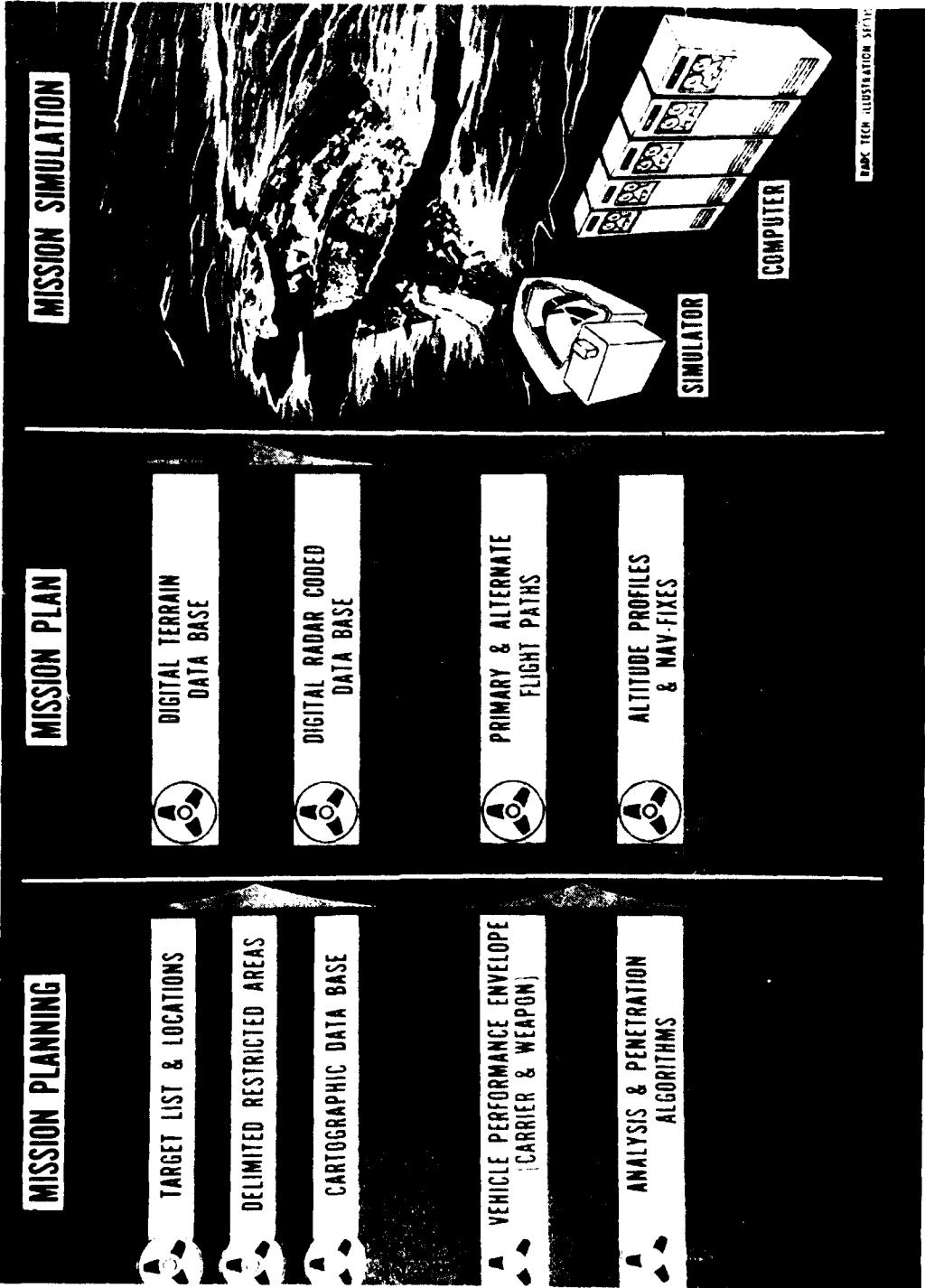
EFFORTS: FY81 TACTICAL DIGITAL MAPPING  
FY82 DATA BASE & FORMAT VALIDATION

POC: RADC/IRRP/KAU E. NEED 315-330-6272

PRECISION GUIDANCE AND STRIKE PRODUCTS (SENSOR SCENE SYNTHESIS)



# MISSION PLANNING - SIMULATION



**PRECISION GUIDANCE AND STRIKE PRODUCTS  
(SENSOR SCENE SYNTHESIS)**

**AREA TITLE: SENSOR IMAGE SIMULATION**

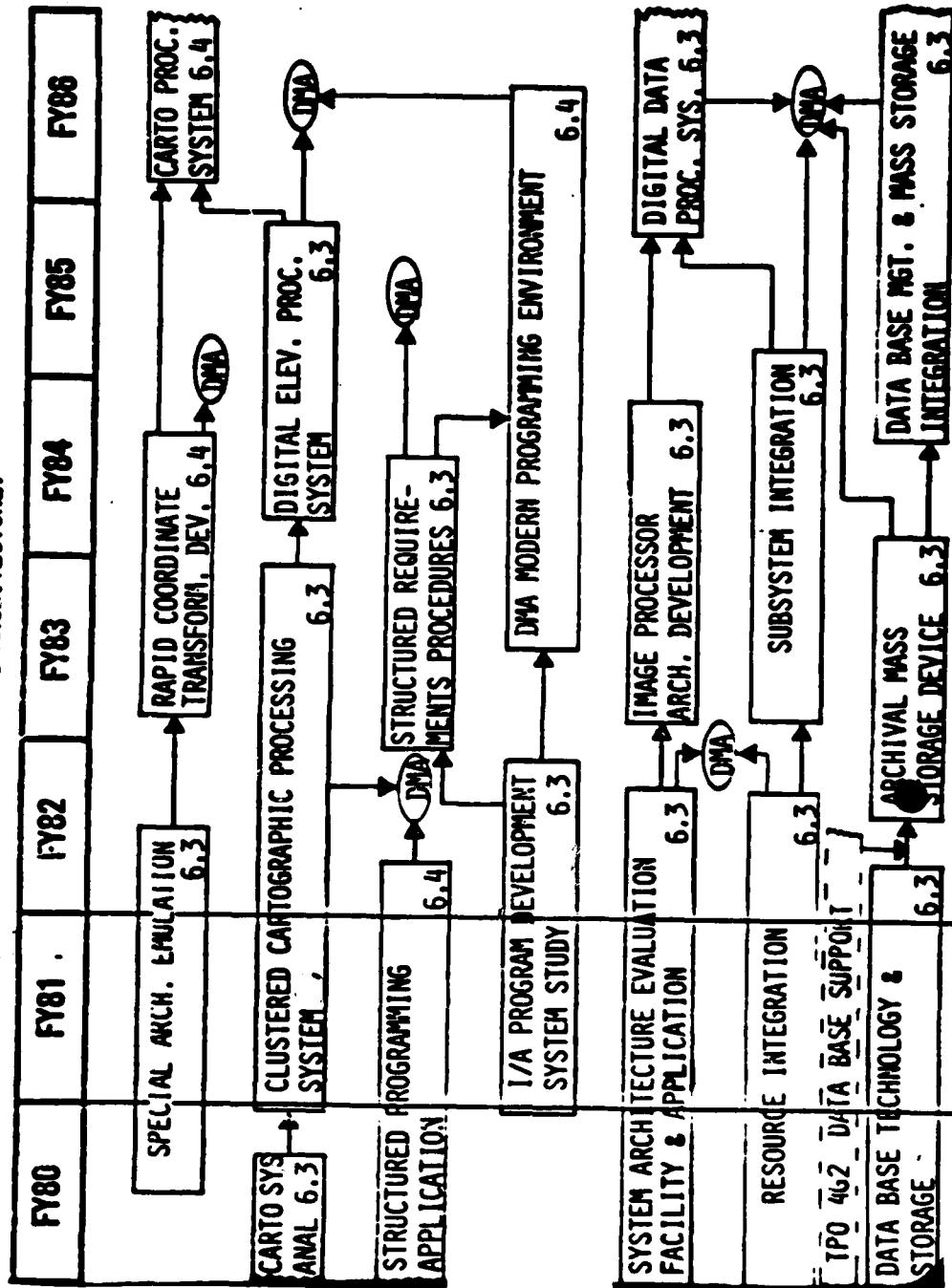
**OBJECTIVE: DETERMINATION OF UNIQUE AND TIME VARIANT DESCRIPTORS TO  
PERMIT THE DFAD DATA BASE TO SUPPORT A WIDE CLASS OF SENSOR  
SIMULATIONS.**

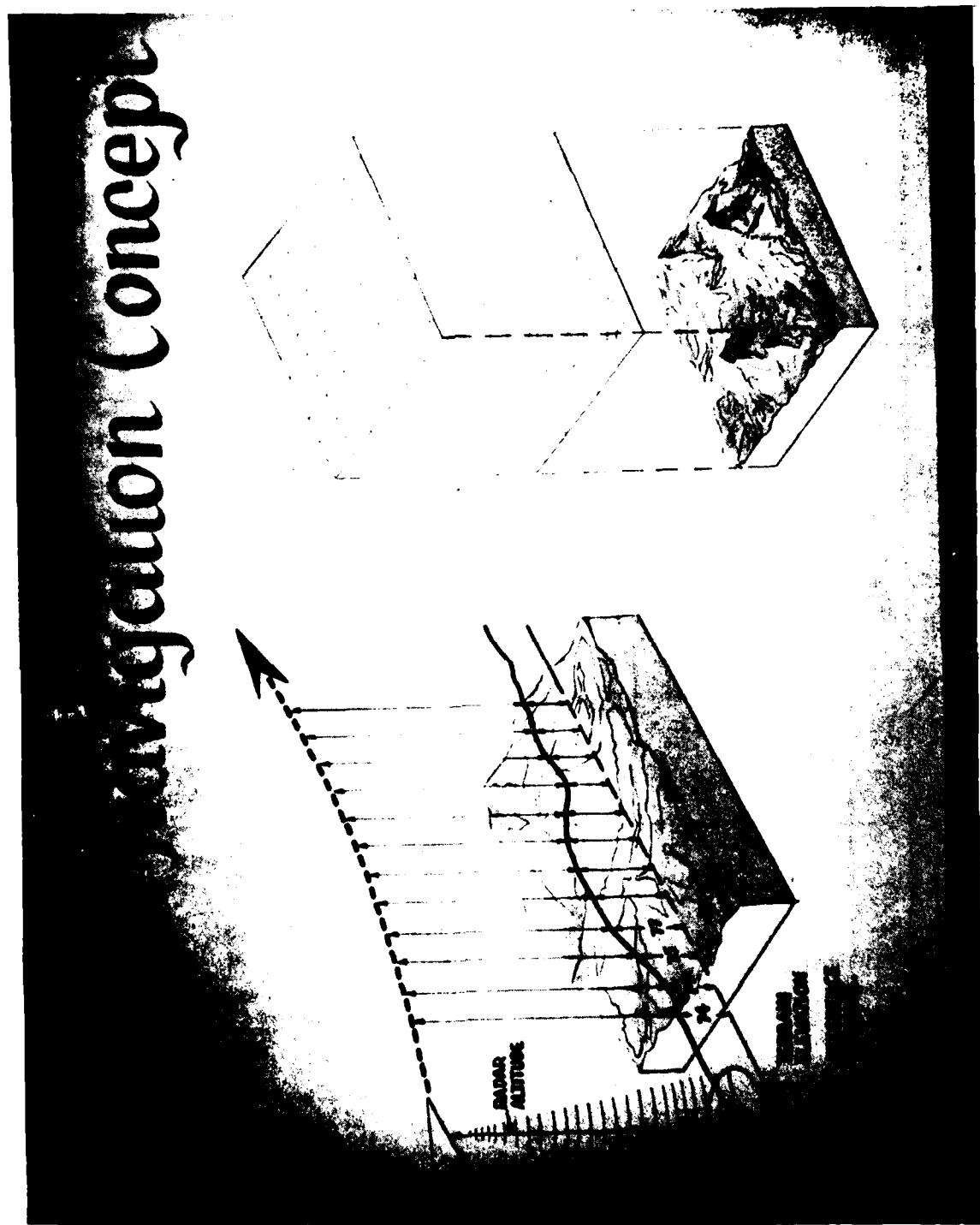
**DETERMINE DATA CHARACTERISTICS TO SUPPORT THE 15F12 NAV  
TRAINER (RADAR) AND VISUAL SIMULATION REQUIREMENTS.**

**EFFECTS: FY81 ADVANCED WEAPONS SIMULATION (TASK A)  
ADVANCED WEAPONS SIMULATION (TASK B)**

**PER: RADC/IRR/R. HOFFMANN 315-330-2217**

PRECISION GUIDANCE AND STRIKE PRODUCTS  
(CARTO PROCESS/DATA BASE/ARCHITECTURE)





**PRECISION GUIDANCE AND STRIKE PRODUCTS**  
**(CARTO PROCESS/DATA BASE/ARCHITECTURE)**

**AREA TITLE:** CARTO PROCESSING SYSTEM

**OBJECTIVE:** PROVIDE TECHNIQUE DEVELOPMENT AND PRODUCTION IMPLEMENTATION  
TO ALLEVIATE DIA DIGITAL DATA PRODUCTION PROCESS PROBLEMS.  
PROVIDE ON-LINE CENTRALIZED CONTROL AND POST-PROCESSING  
FOR EXISTING AND PLANNED DIAAC DIGITAL CARTOGRAPHIC PRODUCTION  
SYSTEMS.

**EFFORTS:** FY81 DIGITAL ELEVATION MATRIX PROCESSING

**POC:** KADC/ISCA/0. REINHAN 315-330-4728

**PRECISION GUIDANCE AND STRIKE PRODUCTS  
(CARTO PROCESS/DATA BASE/ARCHITECTURE)**

**AREA TITLE:** SYSTEM ARCHITECTURE EVALUATION

**OBJECTIVE:** DEVELOP A BASE FOR EXPERIMENTATION WITH COMPUTER ARCHITECTURES  
AND PROCESSING CONFIGURATION EVALUATION. EMPLOY TO MODEL  
PDOP PROCESSING STRUCTURE TO OBLIVIATE PROBLEMS.

**EFFORTS:** FY81 SYSTEM ARCHITECTURE EVALUATION

**POC:** WADC/ISCAVO, REIMANN 315-330-4728

**PRECISION GUIDANCE AND STRIKE PRODUCTS  
(CARTO PROCESS/DATA BASE/ARCHITECTURE)**

**AREA TITLE: RESOURCE INTEGRATION**

**OBJECTIVE:** DETERMINE FEASIBILITY, UTILITY AND COST EFFECTIVENESS  
OF DIA INTRA-CENTER RESOURCE SHARING.  
DESIGN AND IMPLEMENTATION OF A NETWORK OF EXISTING DIGITAL  
IMAGE PROCESSING/AUTOMATED FEATURE EXTRACTION SYSTEMS  
AT THE DIA CENTERS.

**EFFORTS:** FY81 DIAHTC P.S.I. ANALYSIS  
EXPERIMENTAL INTEGRATION IMPLEMENTATION

**POC:** RADC/1SLA/O. REIMANN 315-330-4728

SOLID STATE DEVICE RELIABILITY

585

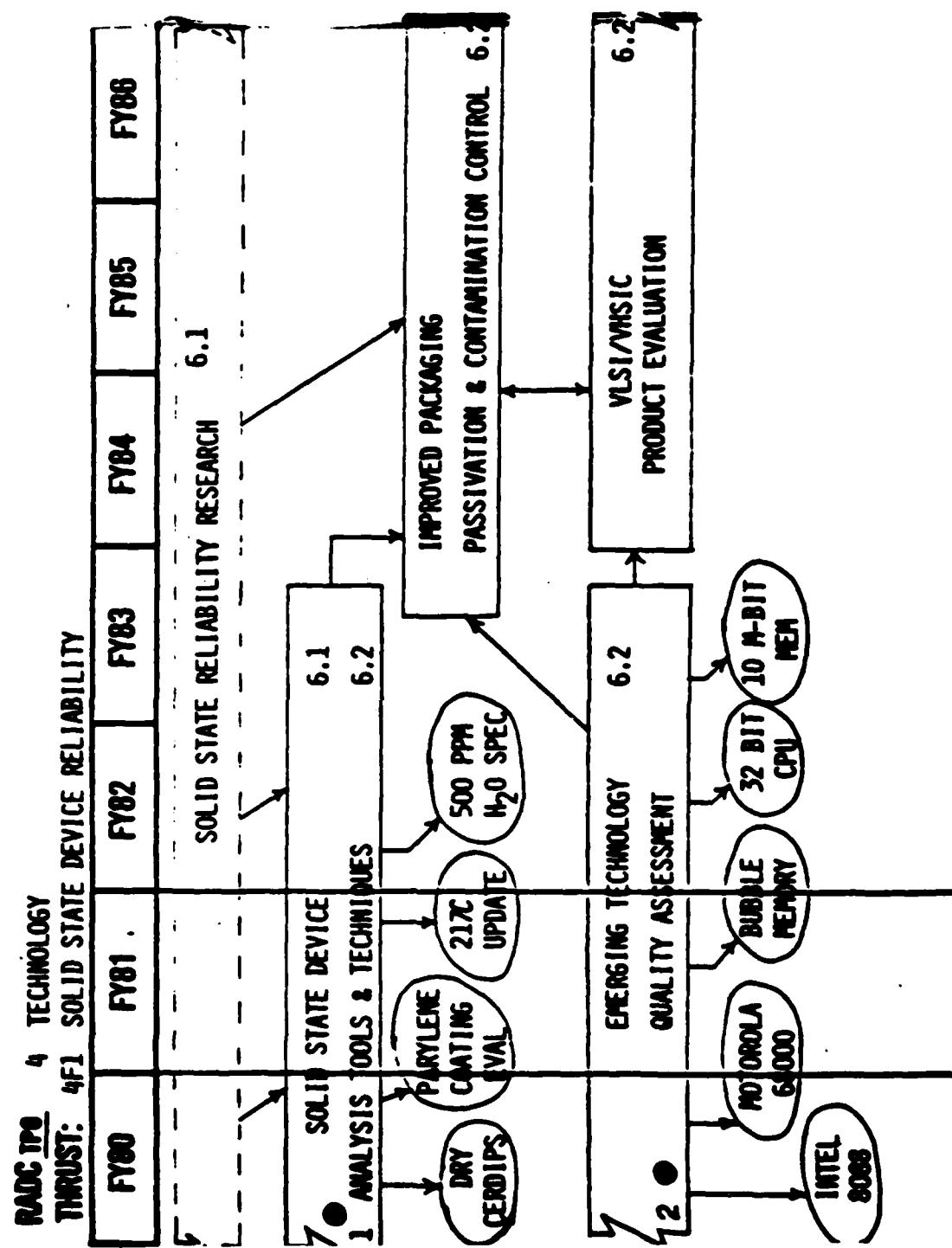
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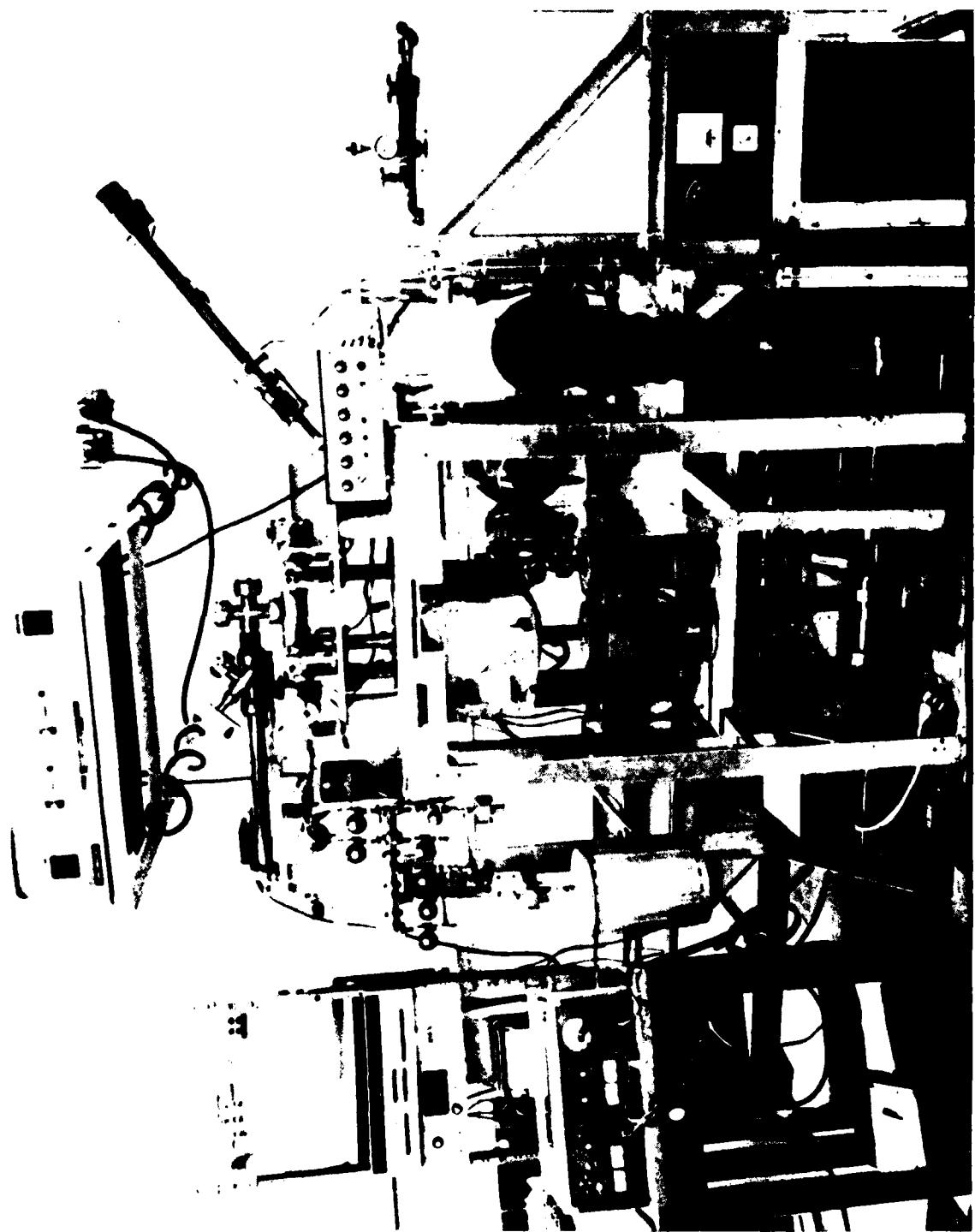
JOHN BART  
RADC/RB

**TPO/THRUST:** HF/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY  
**SUB-THRUST:** LSI/SOLID STATE DEVICE RELIABILITY  
**PROGRAM GOAL:** ASSURE THE AVAILABILITY OF RELIABLE SOLID STATE DEVICES  
FOR AIR FORCE AND DOD ELECTRONIC SYSTEMS

**TECHNICAL AREAS:**

- SOLID STATE DEVICE ANALYSIS TOOLS AND TECHNIQUES
- EMERGING TECHNOLOGY QUALITY ASSESSMENT
- ELECTRICAL CHARACTERIZATION OF SOLID STATE MICROCIRCUITS
- VHVIC TEST TECHNOLOGY
- QUALITY AND RELIABILITY ASSURANCE AND DESIGN CONCEPTS
- RELIABILITY PHYSICS TECHNOLOGY
- ACCELERATED LIFE TESTING AND FAULT DETECTION FOR LSI/MSI
- RELIABILITY ASSESSMENT OF SOLID STATE MICROCIRCUITS





**TPO/THRUST:** ~~RELIABILITY, MAINTAINABILITY AND COMPATIBILITY~~

**SUB-THRUST:** ~~LONG-SHARE DEVICE RELIABILITY~~

**BLOCK TITLE:** ~~SOLID STATE DEVICE ANALYSIS TOOLS AND TECHNIQUES 1~~

**SPECIFIC:** ~~DEVELOP AND MAINTAIN LABORATORY TOOLS TO EXAMINE SOLID STATE DEVICES ELECTRICALLY, MECHANICALLY, AND CHEMICALLY AT THE MICROSCOPIC LEVEL~~

**APPROACH:**

- INCREASE SENSITIVITY OF LABORATORY INSTRUMENTS OF PROVEN VALUE
- ADD FEATURES TO INCREASE THROUGHPUT, ACCURACY, AND CAPABILITY (X-RAY SPECTROMETER, AUTOMATIC SAMPLE CHANGER, INSTRUMENT SOFTWARE)
- DEVELOP NEW CAPABILITY (FLUORESCENCE MICROSCOPE, SUBMICRON AUGER SYSTEM, MICRON PROBE)
- DEVELOP STANDARDS FOR CONTROL/ELIM. OF FOREIGN MATERIAL AND POOR PACKAGING

**PAY-OFF:**

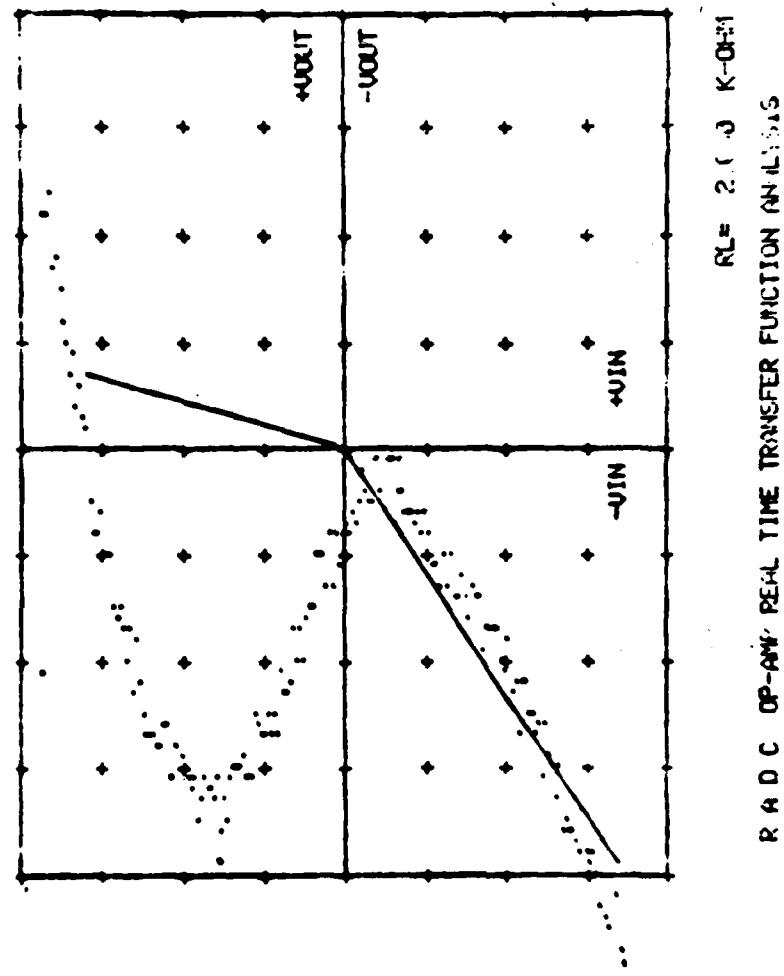
- RELIABLE, LONG-LIFE SOLID STATE DEVICES THROUGH APPLICATION OF EFFECTIVE PACKAGING QUALITY STANDARDS

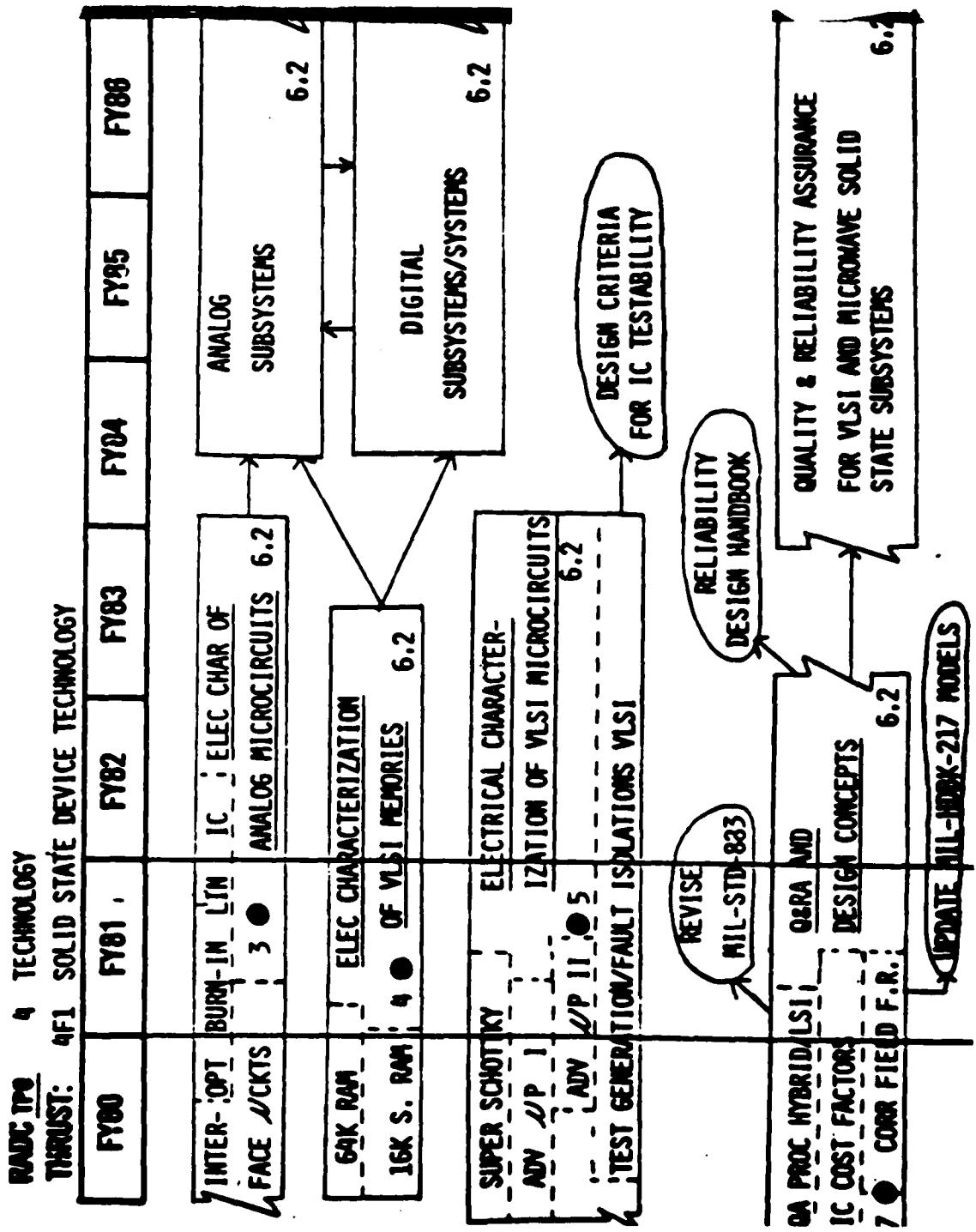


RADC AUTOMATED INTEGRATED CIRCUIT TEST FACILITY



LINE FUND-MIL SY. EQUIVALENT





TPO/THRUST: HF/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY

BLOCK TITLE: ELECTRICAL CHARACTERIZATION OF ANALOG MICROCIRCUITS 3

OBJECTIVE: DETERMINE THE PERFORMANCE, INTERCHANGEABILITY, DESIGN INTEGRITY AND COMPATIBILITY NEEDED TO ASSURE MIL-QUALITY DEVICES

APPROACH:

- USE VENDOR DATA, ELECTRICAL SCHEMATICS AND SUPPLEMENTAL TESTS TO DEVELOP TEST PROCEDURES, TRANSFER FUNCTIONS AND ALGORITHMS
- DETERMINE ALLOWABLE RESPONSES AND LIMITS TO ELECTRICAL, THERMAL AND MECHANICAL STRESSES
- PROVIDE ELECTRICAL PARAMETERS FOR MIL-M-38510 SLASH SHEETS COVERING ANALOG MICROPROCESSOR, DATA ACQUISITION AND INTERFACE MICROCIRCUITS

PAY-OFF:

- RELIABLE ANALOG ICs FOR THE MILITARY ENVIRONMENT

TPO/THRUST: 4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY  
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY  
BLOCK TITLE: ELECTRICAL CHARACTERIZATION OF VLSI MEMORIES 4  
OBJECTIVE: DETERMINE THE PERFORMANCE, INTERCHANGEABILITY, DESIGN INTEGRITY AND COMPATIBILITY NEEDED TO ASSURE MIL-QUALITY DEVICES

APPROACH:

- USE VENDOR DATA, ELECTRICAL SCHEMATICS AND SUPPLEMENTAL TESTING TO DEVELOP INPUT AND CORRESPONDING OUTPUT PATTERNS AND ALGORITHMS
- DETERMINE ALLOWABLE RESPONSES AND LIMITS TO ELECTRICAL, THERMAL AND MECHANICAL STRESSES
- PROVIDE DATA FOR MIL-M-38510 SLASH SHEETS FOR RAM, ROM, PROM, EROM AND BUBBLE MEMORIES

PAY OFF:

- RELIABLE HIGH DENSITY SOLID STATE MEMORIES FOR THE MILITARY ENVIRONMENT

**IPO/THRUST:** 4E/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

**SUB-THRUST:** 1/SOLID STATE DEVICE RELIABILITY

**BLOCK TITLE:** ELECTRICAL CHARACTERIZATION OF VLSI MICROCIRCUITS 5

**OBJECTIVE:** DETERMINE THE PERFORMANCE, INTERCHANGEABILITY, DESIGN INTEGRITY AND COMPATIBILITY NEEDED TO ASSURE MIL-QUALITY DEVICES

**APPROACH:**

- USE VENDOR DATA, ELECTRICAL SCHEMATICS AND SUPPLEMENTAL TESTING TO DEVELOP INPUT AND CORRESPONDING OUTPUT PATTERNS
- DEVELOP NEW TEST GENERATION/FAULT ISOLATION METHODS FOR VLSICS
- DETERMINE FUNCTIONAL AND PARAMETRIC TESTS AND LIMITS
- PROVIDE DATA FOR MIL-M-38510 SLASH SHEETS FOR SUPER SCHOTTKY LOGIC, ADVANCED MICROPROCESSORS, MICROCOMPUTERS, PERIPHERAL SUPPORT CHIPS AND OTHER VLSI MICROCIRCUITS

**PAY OFF:**

- RELIABLE ICs FOR THE MILITARY ENVIRONMENT, MORE COST-EFFECTIVE TESTING AND CRITERIA FOR DESIGNING MORE TESTABLE ICs

**TPO/THRUST:** AIR FORCE RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

**SUB-THRUST:** L/SOLID STATE DEVICE RELIABILITY

**BLOCK TITLE:** QUALITY AND RELIABILITY ASSURANCE AND DESIGN CONCEPTS 7

**OBJECTIVE:** DEVELOP QRA CONCEPTS. EVALUATE COST/BENEFIT AND PRODUCE A COMPREHENSIVE RELIABILITY DESIGN GUIDE

**APPROACH:**

- DEVELOP QA PROCEDURES FOR LSICs, HYBRID ICs AND MICROWAVE TRANSMITTERS
- EVALUATE THE COST AND BENEFITS OF MICROCIRCUITS PROCURED TO DIFFERENT QUALITY AND RELIABILITY LEVELS USED IN AIR FORCE EQUIPMENTS
- CORRELATE FIELD FAILURE RATE RESULTS WITH SPECIFIED DEVICE QUALITY LEVELS AND MIL-HDBK-217 MICROCIRCUIT MODELS
- REVISE MIL-STD-883, MIL-M-38510 AND MIL-HDBK-217 IN ACCORD WITH STUDY RESULTS
- MAINTAIN QUALIFIED PARTS LIST AND STATUS OF NEW PARTS' QUAL FOR USERS
- DEVELOP COMPREHENSIVE RELIABILITY DESIGN PROCEDURES

**PAY OFF:**

- NEEDED QRA CONCEPTS AND STANDARDS
- COST/BENEFIT ASSESSMENT OF QA PROCEDURES
- MORE RELIABLE AIR FORCE EQUIPMENT BY DESIGN



## LIQUID CRYSTAL TESTING OF MICROPROCESSOR



NO BIAS

REGISTER TEST

BAND 104 TECHNOLOGY

## TRIBUNAL: #E1 SMI IN STATE DEVICE RELIABILITY

<b>IPO/THRUST:</b>	<u>4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY</u>
<b>SUB-THRUST:</b>	<u>I/SOLID STATE DEVICE RELIABILITY</u>
<b>BLOCK TITLE:</b>	<u>RELIABILITY PHYSICS TECHNOLOGY 8</u>
<b>OBJECTIVE:</b>	<u>DEVELOP AN UNDERSTANDING OF AND QUANTIFY THE FACTORS WHICH CAUSE FAILURES IN SOLID STATE DEVICES</u>
<b>APPROACH:</b>	<ul style="list-style-type: none"> <li>● INVESTIGATE FACTORS KNOWN TO BE RELIABILITY PROBLEMS <ul style="list-style-type: none"> <li>● ELECTROMIGRATION</li> <li>● LOW YIELD AND POOR RELIABILITY OF SILICON ON SAPPHIRE TECHNOLOGY</li> </ul> </li> <li>● DEVELOP LABORATORY CAPABILITY TO EXAMINE SOLID STATE DEVICES AND MEASURE ELECTRICAL AND CHEMICAL PROPERTIES AT THE MICROSCOPIC LEVEL</li> <li>● DEVELOP A COMBINED ELECTRICAL TEST/E-BEAM PROBE TECHNIQUE FOR DETECTING, LOCATING AND EXAMINING FAULTS ON ICs</li> <li>● FURTHER REFINEMENT AND APPLY THE LIQUID CRYSTAL TECHNIQUES (LOW VOLTAGE LIQUID CRYSTAL, PATTERN RECOGNITION)</li> </ul>
<b>PAY OFF:</b>	<ul style="list-style-type: none"> <li>● IMPROVED UNDERSTANDING OF FAILURE MECHANISMS: INNOVATIVE FAULT IDENTIFICATION METHODS</li> </ul>

TP0/THRUST: 4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY

BLOCK TITLE: ACCELERATED LIFE TESTING AND FAULT DETECTION FOR LSI/WSI 10

OBJECTIVE: DEVELOP AND VALIDATE COMPREHENSIVE AND EFFECTIVE MICROCIRCUIT RELIABILITY TEST TECHNIQUES

APPROACH:

- DEVELOP AUTOMATIC TEST METHODS FOR LINEAR ICs
- IDENTIFY ELECTRICAL INDICATORS OF INTERNAL IC QUALITY
- DEVELOP TESTS TO UTILIZE EXPANDED TEKTRONICS 3270 TESTER CAPABILITY
- REFINE PARALLEL TEST METHOD
- EXPLORE OTHER ACCELERATED TEST AND FAULT DETECTION TECHNIQUES

PAY OFF:

- FASTER, HIGHER CONFIDENCE IC SCREENING TEST METHODS
- RAPID ACCELERATED LIFE TEST METHODS FOR NEW TECHNOLOGIES
- MORE ACCURATE MIL SPEC TEST REQUIREMENTS

RADC TPO 4 TECHNOLOGY  
THRUST: 4F1 SOLID STATE DEVICE RELIABILITY

FY80	FY81	FY82	FY83	FY84	FY85	FY86
111 • MICROWAVE DEVICE FAILURE RATES AND MODES LOW PWR GaAs IMPATT ADV PWR SWITCHING DEVICES					RELIABILITY ASSESSMENT ADVANCED MICROWAVE DEVICES	
112 • NEW TECHNOLOGY RELIABILITY ASSESSMENT SCHOTTKY DIODE NMOS LSI				SUPER SHOTKY 12L HIGH SPEED BIPOLAR (2901A)		RELIABILITY OF HIGH DENSITY SOLID STATE DIGITAL AND ANALOG SUBSYSTEMS
113 • HIGH DENSITY MEMORY RELIABILITY ASSESSMENT CMOS LSI MEMORY					ADVANCED SS MEMORIES	6.2

TOP THRUST: HF RELIABILITY, MAINTAINABILITY AND COMPATIBILITY  
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY  
BLOCK TITLE: MICROWAVE DEVICE FAILURE RATES AND MODES II  
OBJECTIVE: DETERMINE FAILURE RATE AND CAUSE OF FAILURE IN STATE-OF-THE-ART MICROWAVE  
DEVICES

APPROACH:

- SELECT REPRESENTATIVE POWER\_GAAS\_FETs AND ADVANCED\_POWER\_SWITCHING  
DEVICES
- APPLY ACCELERATED LIFE TESTS
- EXAMINE FAILED DEVICES AND DETERMINE CAUSE
- TRANSFER RESULTS AND CONCLUSIONS TO VENDORS AND SYSTEM DESIGNERS

PAY OFF:

- FEEDBACK TO DEVICE VENDORS TO CORRECT PROBLEMS
- DEFINITION OF DEVICE TOLERANCE PARAMETERS
- RELIABLE, SUPPORTABLE SYSTEM DESIGN

TPO/THRUST: 4E/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY

BLOCK TITLE: NEW TECHNOLOGY RELIABILITY ASSESSMENT 12

OBJECTIVE: DETERMINE FAILURE RATE AND CAUSE OF FAILURE IN NEW SOLID STATE TECHNOLOGIES

APPROACH:

- SELECT DEVICES REPRESENTATIVE OF SUPER\_SCHOTTKY, L2L AND HIGH SPEED BIPOLAR
- APPLY ACCELERATED LIFE TESTS
- APPLY MIL SPEC SCREEN TESTS WHERE AVAILABLE TO DETECT FAULTS

PAY OFF:

- EARLY FAILURE RATE DATA FOR SYSTEM DESIGNERS
- FEEDBACK TO MIL SPECS IMPROVES ACCURACY
- FEEDBACK TO DEVICE VENDOR TO CORRECT PROBLEMS

TP0/THRUST: 4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY  
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY  
BLOCK TITLE: HIGH DENSITY MEMORY RELIABILITY ASSESSMENT 13  
OBJECTIVE: DETERMINE FAILURE RATE AND CAUSE OF FAILURE IN NEW SOLID STATE MEMORY TECHNOLOGIES

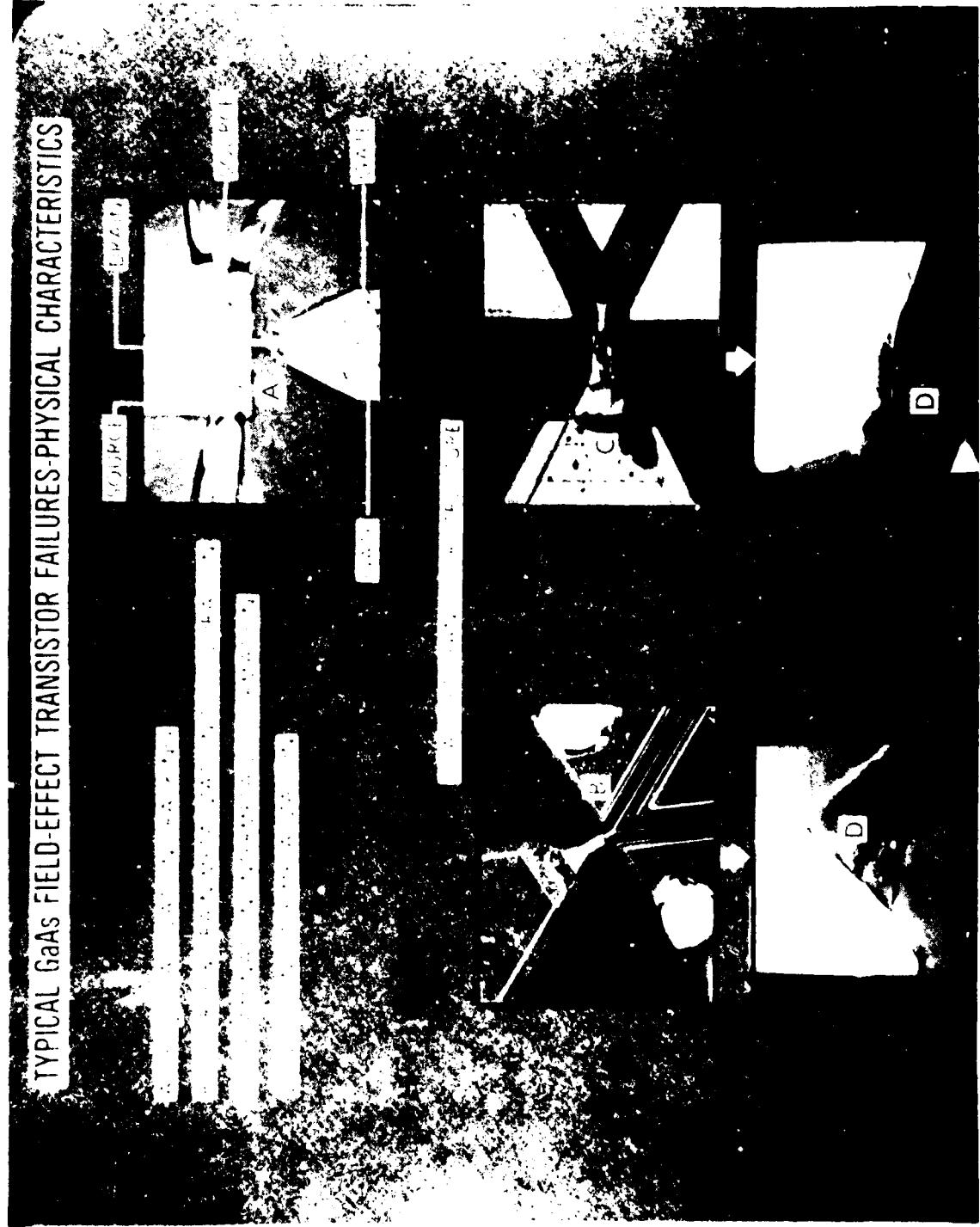
APPROACH:

- SELECT DEVICES REPRESENTATIVE OF 54\_KBIT\_DYNAMIC, 15K\_BIT\_STATIC.  
AND NONVOLATILE REPROGRAMMABLE ROMS
- APPLY ACCELERATED LIFE TESTS
- APPLY MIL SPEC SCREEN TESTS WHERE AVAILABLE TO DETECT FAULTS
- EXAMINE FAILED DEVICES AND DETERMINE CAUSE

PAY OFF:

- EARLY FAILURE RATE DATA FOR SYSTEM DESIGNERS
- FEEDBACK TO MIL SPECS IMPROVES ACCURACY
- FEEDBACK TO DEVICE VENDOR TO CORRECT PROBLEMS

TYPICAL GaAs FIELD-EFFECT TRANSISTOR FAILURES-PHYSICAL CHARACTERISTICS



**SOLID STATE DEVICE RELIABILITY  
KEY PERSONNEL**

**JOSEPH BRAIER**

**CHIEF, R&R**

**(315)-330-3396**

**EDWARD O'CONNELL**

**RELIABILITY ASSURANCE SECTION**

**(315)-330-2047**

**ROBERT THOMAS**

**PRODUCT EVALUATION SECTION**

**(315)-330-4632**

**ALFRED TAMBURRINO**

**RELIABILITY PHYSICS SECTION**

**(315)-330-2813**

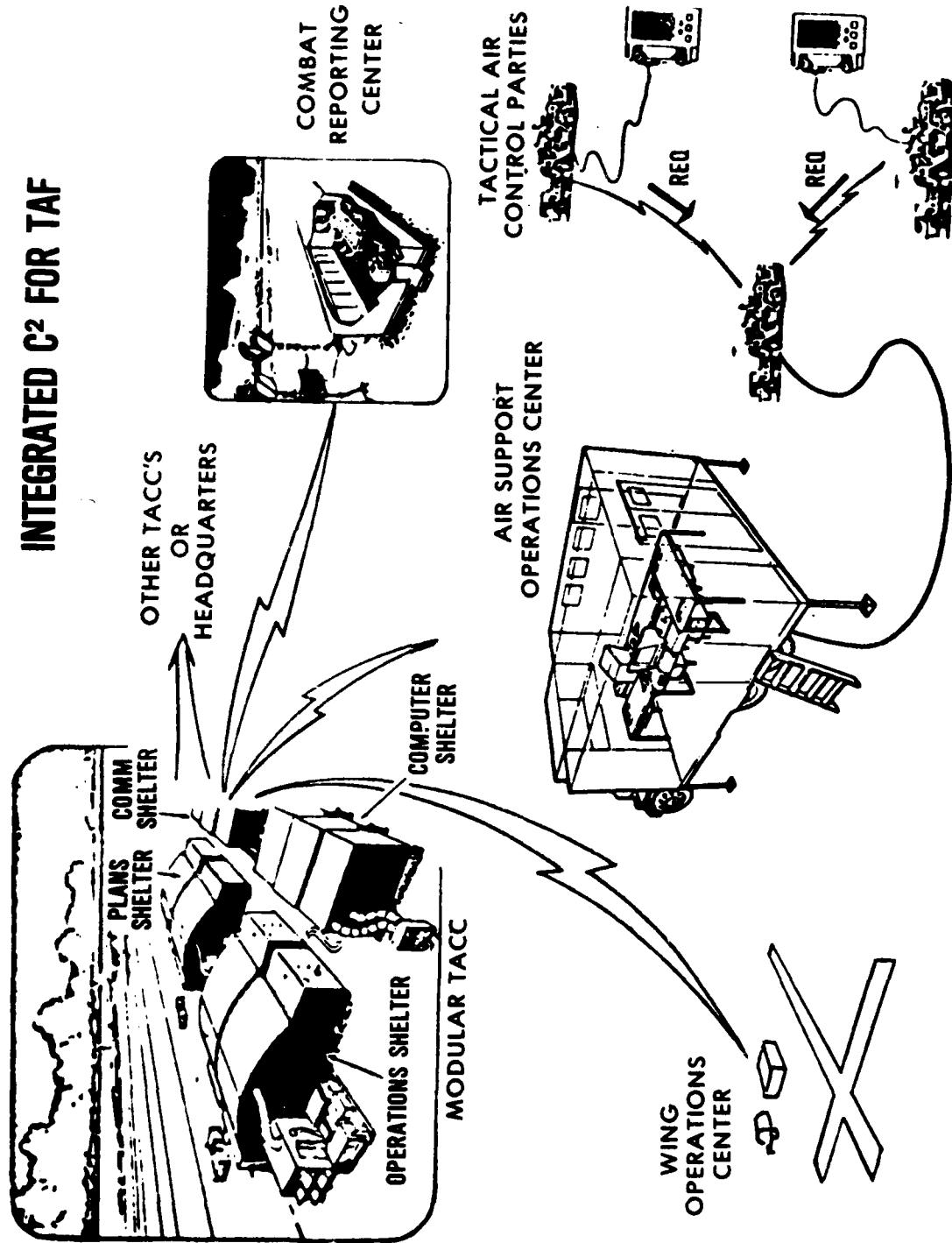
INDUSTRY LOOKS AT PACIFIC 1980

INFORMATION PROCESSING STRUCTURES SUBTEAMST - TP0461

INFORMATION PROCESSING DATABASES SUBTEAMST - TP0462

RICHARD A. KETZER  
INTERACTIVE PROCESSING SECTION  
ISCP/2046

## INTEGRATED C<sup>2</sup> FOR TAF



## INTEGRATED C<sup>2</sup> FOR TAF

### OBJECTIVES:

- ELIMINATE CHOKEPONTS THRU DECISION AIDS
  - DATA AGGREGATION & DISPLAY
  - REAL TIME OPTION GENERATION
- DEVELOP GENERALIZED DATA SHARING FOR DECENTRALIZED OPERATIONS
  - DEVELOP CAPABILITY TO ESTABLISH BACK-UP OPERATION
  - DEMONSTRATE CAPABILITIES IN REALISTIC USER ENVIRONMENT
    - OPERATIONAL COMPUTERS
    - EXPANDABLE ARCHITECTURE

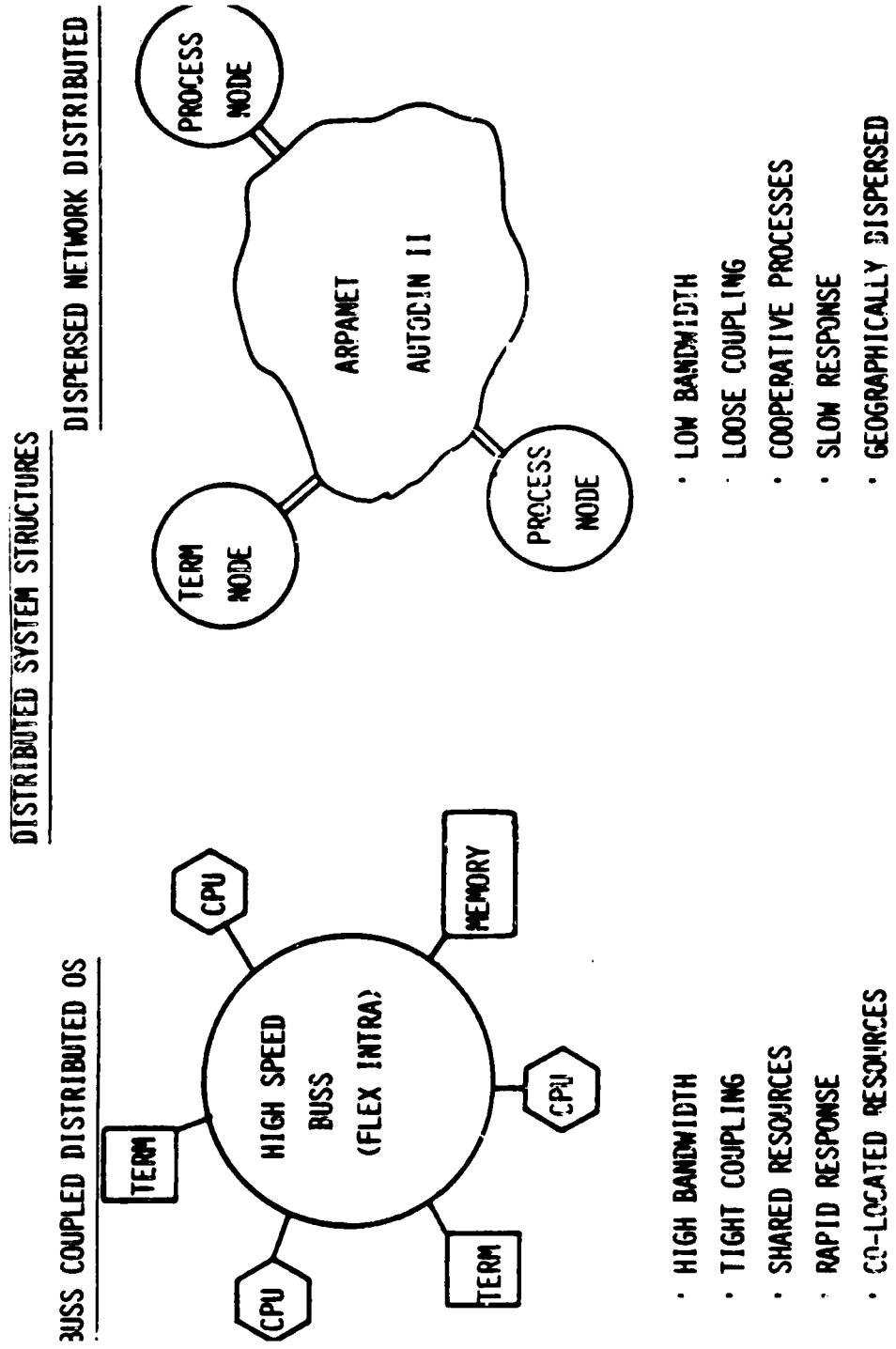
## INTEGRATED C<sup>2</sup> FOR TAF

### APPROACH:

- ESTABLISH COMPARABLE C' COMPUTER ENVIRONMENT
- DEMONSTRATE BUSS ORIENTED C' CENTER
- DEMONSTRATE C' CENTER INTERNETTING
- DEMONSTRATE SOFTWARE IMPLEMENTATIONS OF DECISION AIDS

## SYSTEM SOPHISTICATION

STAND ALONE SYSTEMS		SYSTEMS EXCHANGE BIT STREAMS	OPERATING SYSTEMS INTERACT	APPLICATIONS LEVELS INTERACT
• VERBAL & RECORD COMM	• TOPOLOGY	• HOMOGENEOUS/ HETEROGENEOUS	• HOMOGENEOUS/ HETEROGENEOUS	• HOMOGENEOUS/ HETEROGENEOUS
• CENTRALIZED DATA	• TRANSPORT PROTOCOL (X.25,HDLC)	• INTER PROCESS COMM	• GLOBAL TASK SCHEDULING	• PROCESS MIGRATION
• AUTONOMOUS	• PROCESS INITIATION	• STRUCTURED FILE TRANSFER	• DISPERSED DMS	• CONCURRENCY CONTROL
• MANUAL INTERFACE TO OTHER SYSTEMS	• REMOTE TERMINAL ACCESS	• NETWORK OPERATING SYSTEM	• TASK ALLOCATION	• SYNCHRONIZATION
	• SIMPLE FILE TRANSFER		• COMMON COMMAND LANGUAGE	• DISTRIBUTED OPERATING SYS
			• FUNCTIONAL ALLOCATION	• SHARED RESOURCES
				EXAMPLES
• 407L	• 485L	• WIN	• NSW	• WWMCCS/IDHS
• AIRLINE RESERVATION	• MSG HANDLING	• RSEXEC	• XNOS	• XNDM
	• RJE SYSTEMS	• DECPNET	• SDD-1	• ADAPT
	• ARPANET	• SNA	• F-16	• ASATI
		• DAIS		



## DISTRIBUTED SYSTEM ARCHITECTURE AND CONTROL

### CURRENT TECHNOLOGY ISSUES

#### LEVEL OF CONTROL CENTRALIZATION

CENTRALIZED/DETERMINISTIC  
DECENTRALIZED/NON-DETERMINISTIC

#### LOCAL OPERATING SYSTEM AUTONOMY

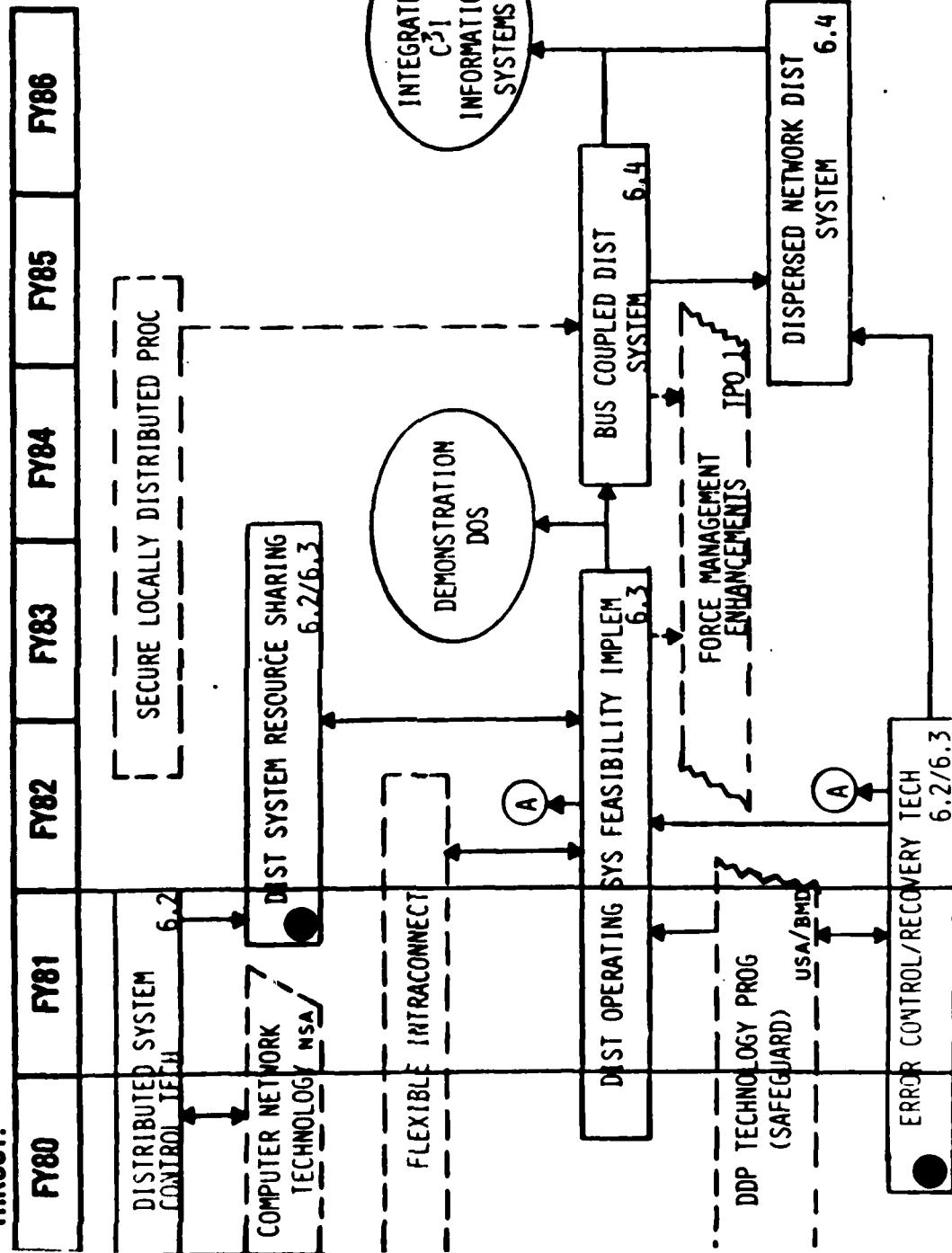
#### INTERPROCESS COMMUNICATION

#### TRANSPARENCY - USER LEVEL

#### ERROR CONTROL

#### RESOURCE SHARING

RADC TPG 4 TECHNOLOGY  
THRUST: 461 C3I SYSTEM STRUCTURES



TP0/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 461 C31 SYSTEM STRUCTURES

BLOCK TITLE: DISTRIBUTED SYSTEM RESOURCE SHARING

OBJECTIVE: • TO PROVIDE SOFTWARE CONTROL MANAGEMENT WHICH MUST PRESENT TO THE USER THE WHOLE SET OF DISTRIBUTED RESOURCES AS BELONGING TO A SINGLE MACHINE

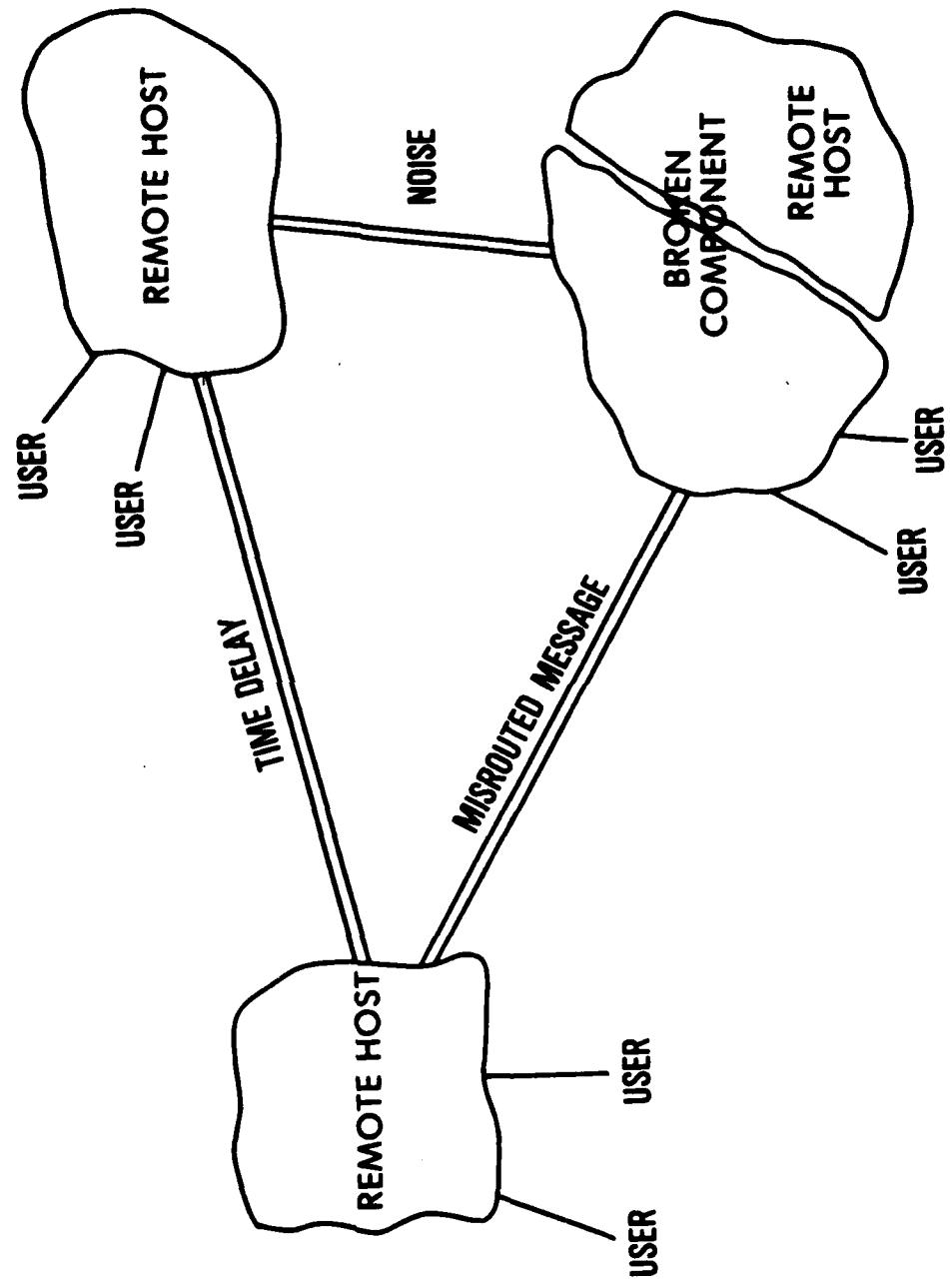
TECHNICAL APPROACH: • DEVELOP ALGORITHMS AND DEMONSTRATION SOFTWARE

- DISTRIBUTED TASK EXECUTION
- DISTRIBUTED SYSTEM EXECUTIVE CONTROL
- SYSTEM PRIMITIVES TO STRUCTURE AND MODIFY CONFIGURATION

PAY-OFF: • INCREASED PROCESSING EFFICIENCY

- LOAD LEVELING
- RECONFIGURABILITY

## DISTRIBUTED SYSTEM FAULTS



TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

THRUST/SUB-THRUST/SUB-SUB-THRUST #TITLE: 461 C<sup>3</sup>I SYSTEM STRUCTURES

BLOCK TITLE: ERROR CONTROL/RECOVERY TECHNIQUES

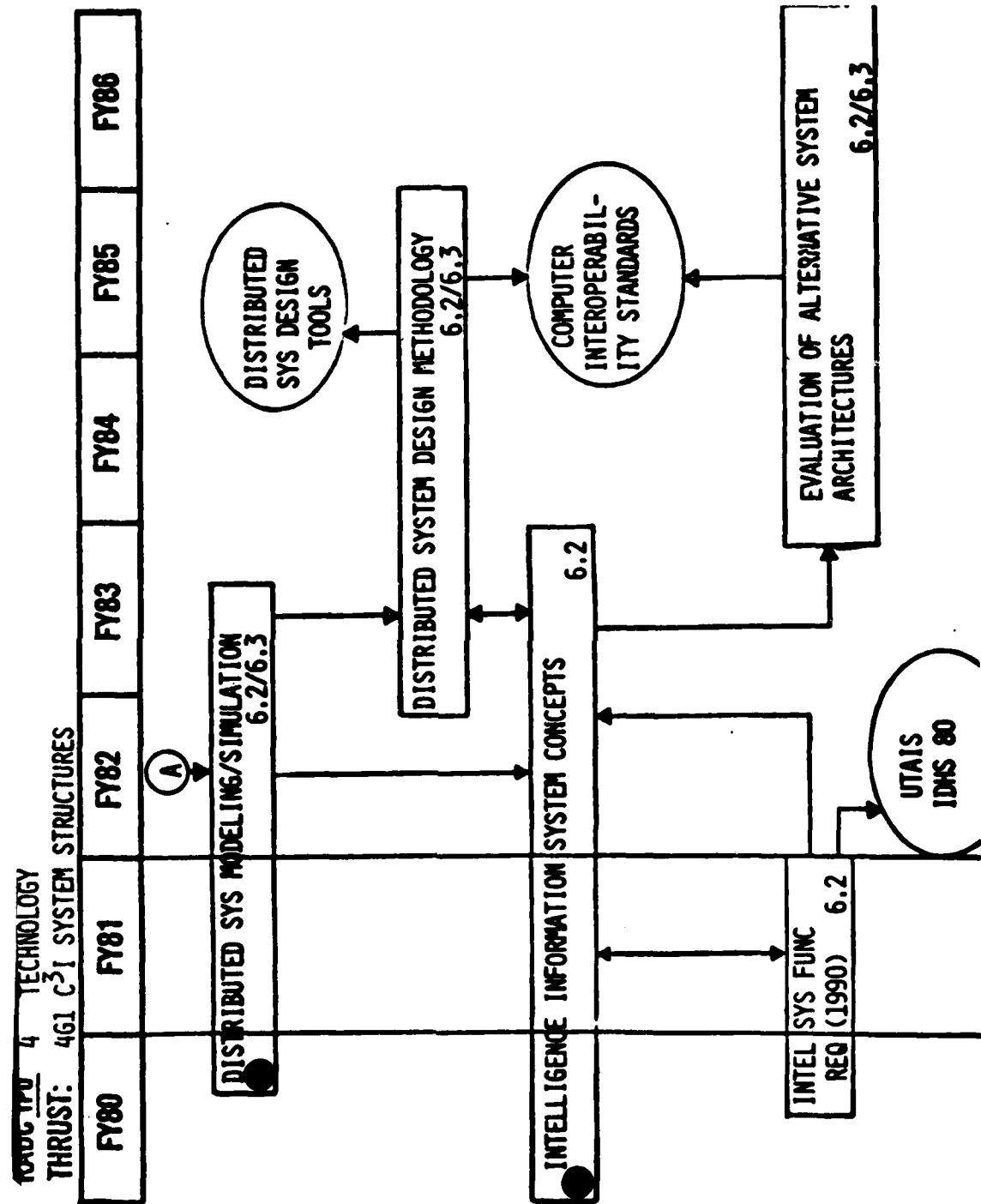
OBJECTIVE: • ESTABLISH FEASIBILITY OF ERROR DETECTION, ISOLATION AND  
RECOVERY TECHNIQUES

• DEVELOP METHODOLOGY FOR ALGORITHM VERIFICATION

TECHNICAL APPROACH: DEVELOPMENT OF TECHNIQUES, TOOLS, MODELS AND SOFTWARE TO ADDRESS:

- EFFECTS OF SYSTEM PARTITIONING
- TASK PERSISTENCE/REINITIATION
- SYSTEM RECONFIGURATION

PAY-OFF: THIS WORK IS FUNDAMENTAL TO THE ACHIEVEMENT OF SURVIVABILITY IN A DISTRIBUTED  
SYSTEM THROUGH RESOURCE REALLOCATION.



TPO/THRUST TITLE: 46 INFORMATION PROCESSING

SUB-THRUST TITLE: 461 C<sup>3</sup>I SYSTEM STRUCTURES

BLOCK TITLE: DISTRIBUTED SYSTEM MODELING/SIMULATION

OBJECTIVE: TO DEVELOP A COMPREHENSIVE MODELING AND SIMULATION CAPABILITY TO ALLOW  
EVALUATION OF THE PERFORMANCE, ROBUSTNESS AND SURVIVABILITY OF DISTRIBUTED SYSTEMS.

TECHNICAL APPROACH: ADAPT EXISTING CAPABILITIES FOR PERFORMANCE MODELS TO INCORPORATE  
DISTRIBUTION OF FUNCTIONS. DEVELOP CAPABILITY TO MODEL RELIABILITY AND ERROR CONDITIONS  
OF A DISTRIBUTED ADP SYSTEM.

PAY OFF: HIGH

TPD/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 461 C<sup>3</sup>I SYSTEM STRUCTURES

BLOCK TITLE: INTELLIGENCE INFORMATION SYSTEM CONCEPTS

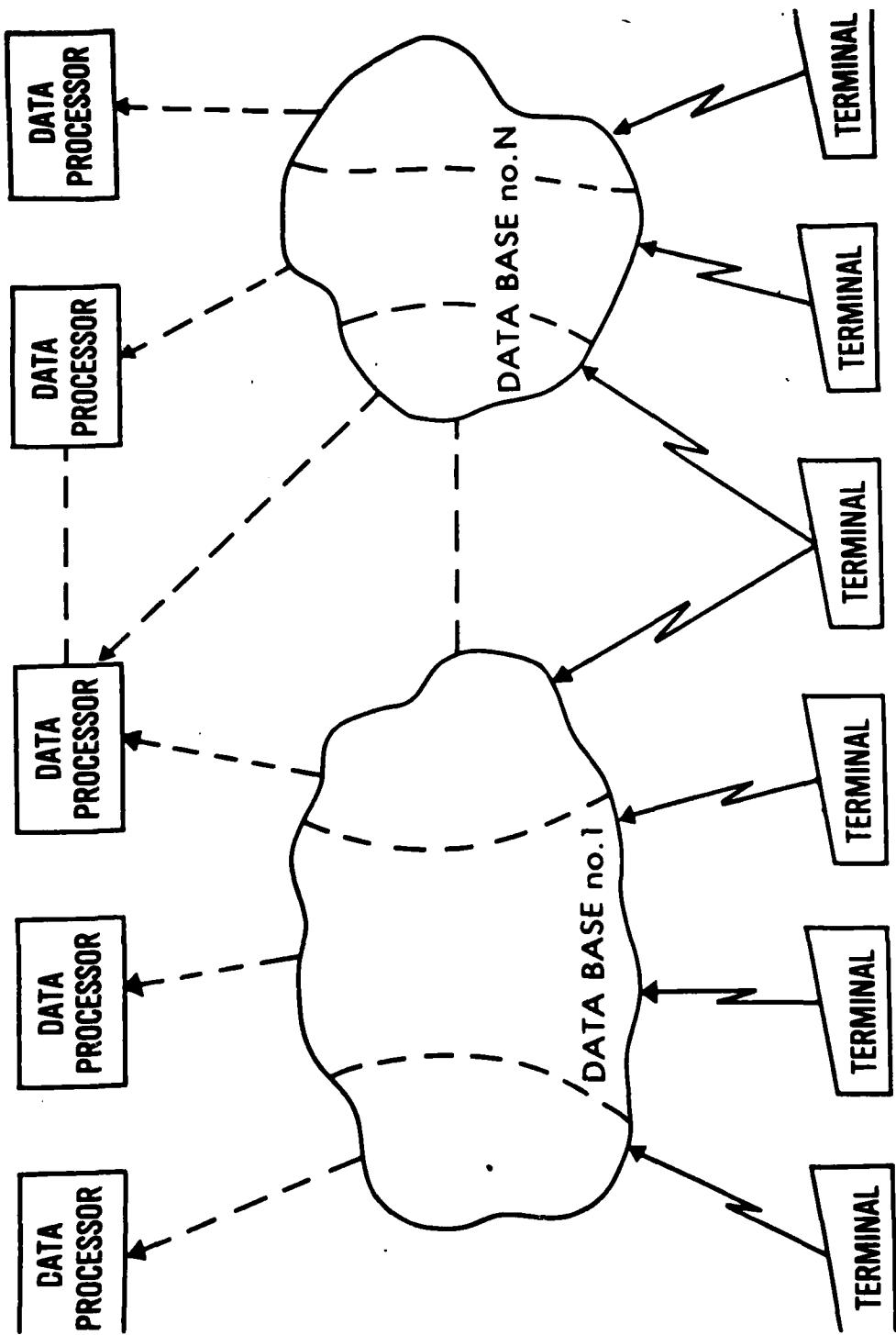
OBJECTIVE: TO EXPLORE POTENTIAL INFORMATION SYSTEM CONCEPTS FOR SATISFYING/SOLVING THE  
THROUGHPUT, CAPACITY, AND RESPONSIVENESS REQUIREMENTS IMPOSED ON INTELLIGENCE PROCESSING  
SYSTEMS.

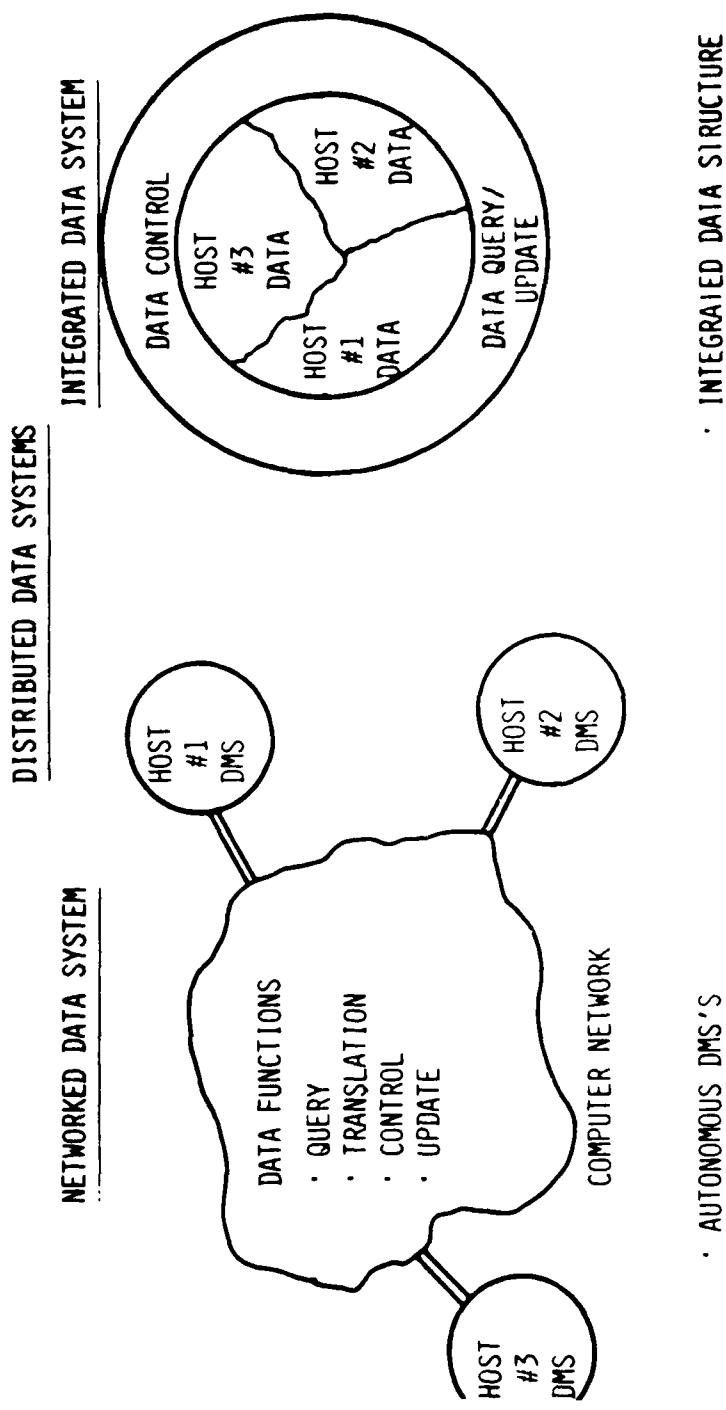
TECHNICAL APPROACH: HIGH TECHNOLOGY INFORMATION PROCESSING TECHNIQUES (HARDWARE & SOFTWARE  
EMERGING FROM GOVERNMENT 6.1, COMMERCIAL INDUSTRY AND UNIVERSITY RESEARCH WILL BE ANALYZED  
FOR POTENTIAL CONTRIBUTION TO THE REQUIREMENT STATED IN THE PEO/C OBJECTIVE.

PAY-OFF: THE PAY-OFF IS IN THE POTENTIAL TO ACHIEVE THE PROCESSING CAPACITIES TO EFFECTIVELY  
UTILIZE AND SUPPLY ESSENTIAL INFORMATION FOR THE COLLECTIVE AND STRIKE SYSTEMS OF THE  
1990 TIMEFRAME.

INFORMATION PROCESSING DATABASES SUBTHRUST 1 - TP0462

## DISTRIBUTED DATA BASE PROBLEM





- INTEGRATED DATA STRUCTURE
- GLOBAL CONTROL
- UNIFIED QUERY/UPDATE CAPABILITY
- PARTITIONING/ALLOCATION
- SYNCHRONIZATION/CONCURRENCY

- AUTONOMOUS DMS'S
- TRANSPARENT ACCESS
- NETWORK OVERHEAD
- SYNCHRONIZATION/CONCURRENCY

**DISTRIBUTED DATABASES**

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**CURRENT TECHNOLOGY ISSUES**

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**DATABASE INTEROPERABILITY**

**MULTIUSER ACCESS**

**DISTRIBUTED DATABASE DESIGN**

**CONCURRENCY CONTROL/SYNCHRONIZATION**

**USER INTERFACE**

**RADC TR 4 TECHNOLOGY**  
**THRUST: 462 C3I DATABASE SYSTEMS**

FY80	FY81	FY82	FY83	FY84	FY85	FY86
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DATABASE DESIGN/ANALYSIS

6.2

DATABASE DESIGNERS WORKBENCH

6.4

DATABASE MODELING/SIMULATION

6.2/6.3

INTROSPECTIVE DATABASE

6.2

ACTIVE DATABASE TECHNOLOGY

6.2

DESIGN  
TOOLS  
ENVIRONMENT

PERF/REL  
MODELS

ACTIVE INFORMATION SYSTEM TECHNOLOGY

SECURE DATABASE MANAGEMENT SYSTEM

TP0/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 462 C31 DATABASE SYSTEMS

BLOCK TITLE: DATABASE DESIGN/ANALYSIS

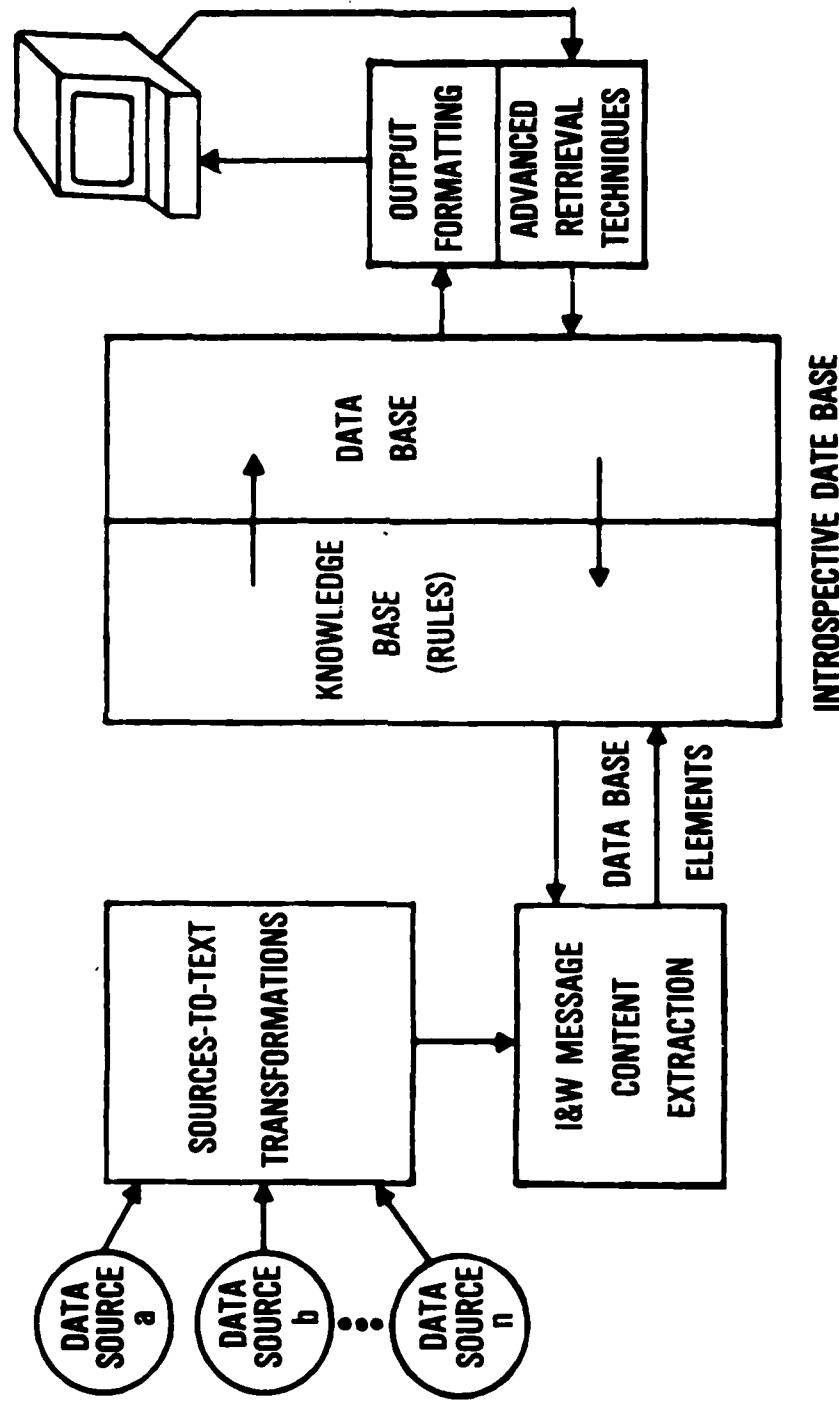
OBJECTIVE: DEVELOP AND EVALUATE DATABASE DESIGN TOOLS FOR SINGLE AND MULTINODE SYSTEMS. ANALYZE AND DESIGN A STRUCTURE FOR INTEGRATING THESE TOOLS.

TECHNICAL APPROACH: INSTALL AND EVALUATE TOOLS DEVELOPED AND COLLECTED UNDER PREVIOUS EFFORT.

- IDENTIFY FORMATS AND INTERFACE PARAMETERS.
- DESIGN A STRUCTURE TO TIE THE TOOLS TOGETHER.

PAY OFF: SUPPORTS RAPID AND EFFECTIVE DEVELOPMENT AND EVALUATION OF DATA BASE SYSTEMS.

## ACTIVE SYSTEMS/KNOWLEDGE PROCESSING



THRU/THRUST TITLE: 46 INFORMATION PROCESSING

SUB-THRUST TITLE: 462 C<sup>3</sup>I DATA BASE SYSTEMS

BLOCK TITLE: ACTIVE DATA BASE TECHNOLOGY

OBJECTIVE: PERMIT COMPONENTS OF DATA STRUCTURE TO ACTIVELY PROCESS INCOMING DATA:

- TRACK INTERNALLY DERIVED INFORMATION GOALS
- PERFORM INDUCTION AND DEDUCTION
- ALERT WHEN CONDITIONS SATISFIED

TECHNICAL APPROACH: • DEVELOP ALGORITHMS TO ORGANIZE AND ADAPT INCOMING DATA

- ARTIFICIAL INTELLIGENCE
- COMPUTATIONAL LINGUISTICS

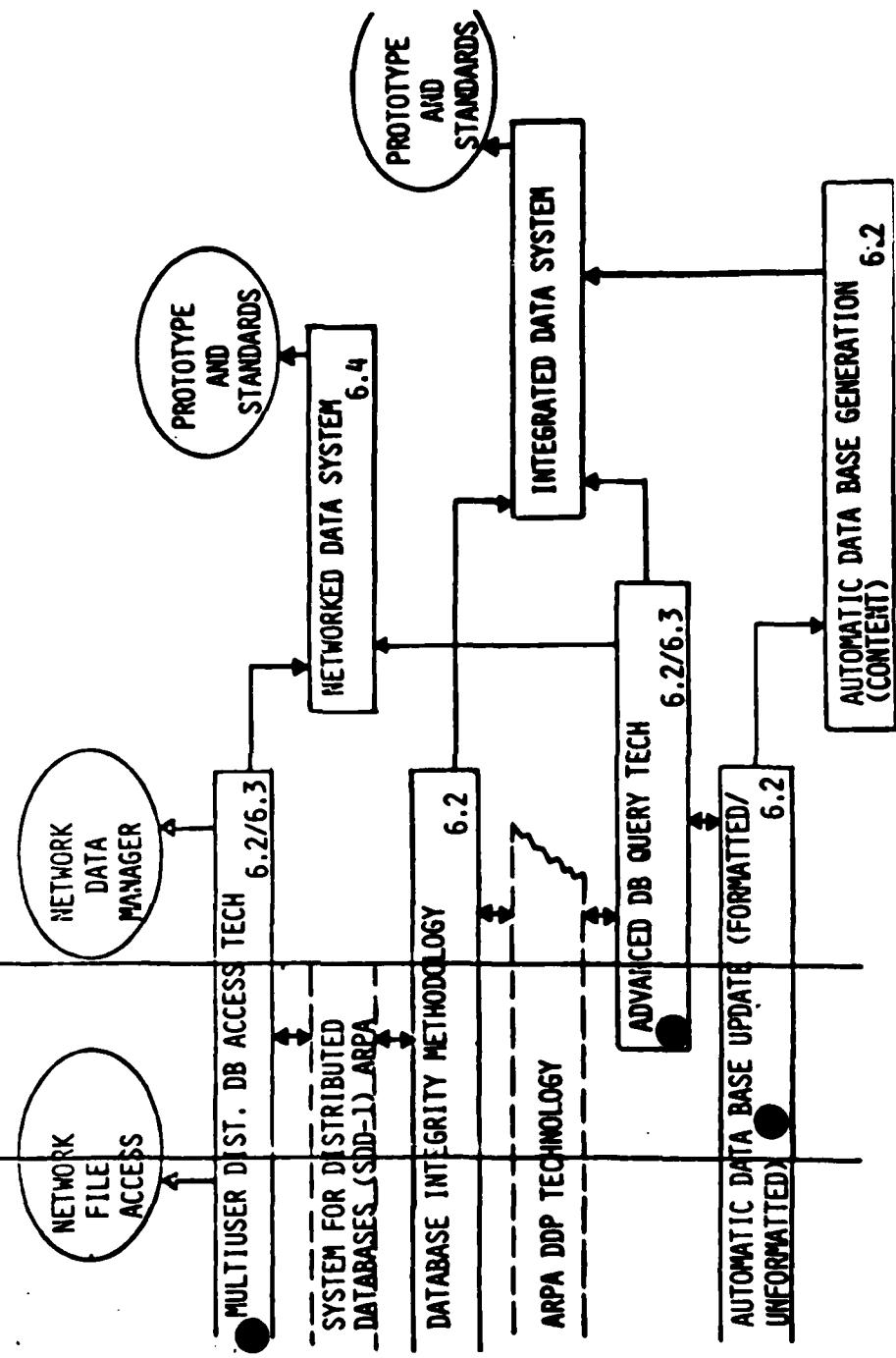
PAY-OFF: • EXTEND EXPERT ANALYST CAPABILITY

- DECREASE ANALYSIS TIME

- SIMPLIFY INTERROGATION TASKS

**FUNCTIONAL TECHNOLOGY**  
**THRUST: 462 C<sup>3</sup>1 DATABASE SYSTEMS**

FY80	FY81	FY82	FY83	FY84	FY85	FY86
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TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 462 C31 DATABASE SYSTEMS

BLOCK TITLE: MULTI USER DISTRIBUTED DATABASE ACCESS TECHNOLOGY

OBJECTIVE: TO INVESTIGATE THE ISSUES INVOLVED IN PROVIDING ACCESS TO DISSIMILAR DATABASES AND DATA MANIPULATION CAPABILITIES IN NETWORKS OF HETEROGENEOUS HARDWARE AND SOFTWARE SYSTEMS.

TECHNICAL APPROACH: DEVELOP TECHNOLOGY TO PROVIDE:

- DATA ELEMENT LEVEL INTERCHANGE BETWEEN DISSIMILAR DBMS's.
- DEVELOP A NETWORK DATA MANAGER TO PROVIDE QUERY TRANSLATION, DATA TRANSFORMATION AND DATA INTEGRITY IN A NETWORKED SYSTEM.
- INVESTIGATE ISSUES OF USER INTERFACE, AND EVALUATE DEVELOPED TECHNIQUES IN THE NETWORK INTERFACE FACILITY.

PAYOUT: HIGH. THE ABILITY TO EFFECTIVELY ACCESS AND MIGRATE DATA IN A DISTRIBUTED SYSTEM IS CRITICAL TO SYSTEM SURVIVABILITY.

PRO/THRUST TITLE: 46 INFORMATION PROCESSING

SUB-THRUST TITLE: 462 C31 DATABASE SYSTEMS

BLOCK TITLE: ADVANCED DATABASE QUERY TECHNIQUES

OBJECTIVE: • ANALYZE USER DATA MANIPULATION CAPABILITY  
• DEVELOP DATA QUERY/MANIPULATION

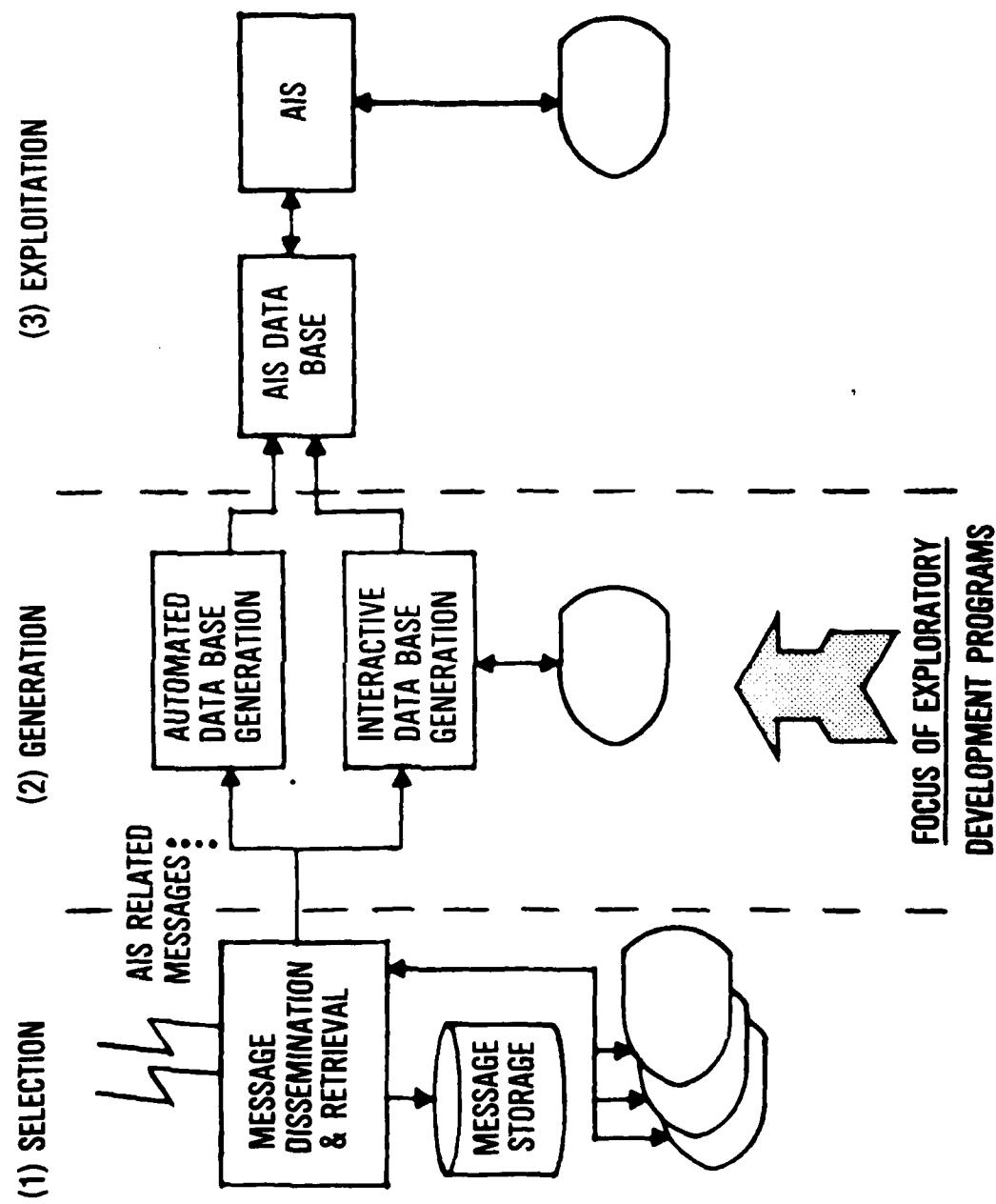
- NETWORKED SYSTEM
- HETEROGENEOUS HARDWARE
- DISSIMILAR DATABASE SYSTEMS

TECHNICAL APPROACH: DEVELOP AND DEMONSTRATE ALGORITHMS TO SUPPORT:

- ACCESS PLANNING
- NATURAL LANGUAGE USER INTERFACE
- COMMON QUERY ACROSS MULTIPLE HETEROGENEOUS SYSTEMS

PAY-OFF: THE ABILITY TO PROVIDE COMMON ACCESS TO HETEROGENEOUS DBS THROUGH COMMON SYNTAX AND SEMANTICS OF QUERY LANGUAGE.

## COMPONENTS OF AN EXPERIMENTAL MESSAGE EXPLOITATION SYSTEM



TP0/THRUST TITLE: 46 INFORMATION PROCESSING

SUB-THRUST TITLE: 462 C3I DATABASE SYSTEMS

BLOCK TITLE: AUTOMATIC DATABASE UPDATE

OBJECTIVE: DEVELOP LINGUISTIC TECHNIQUES:

- EXTRACT DATA ELEMENTS FROM MESSAGES
- AUTOMATICALLY UPDATE DATABASE

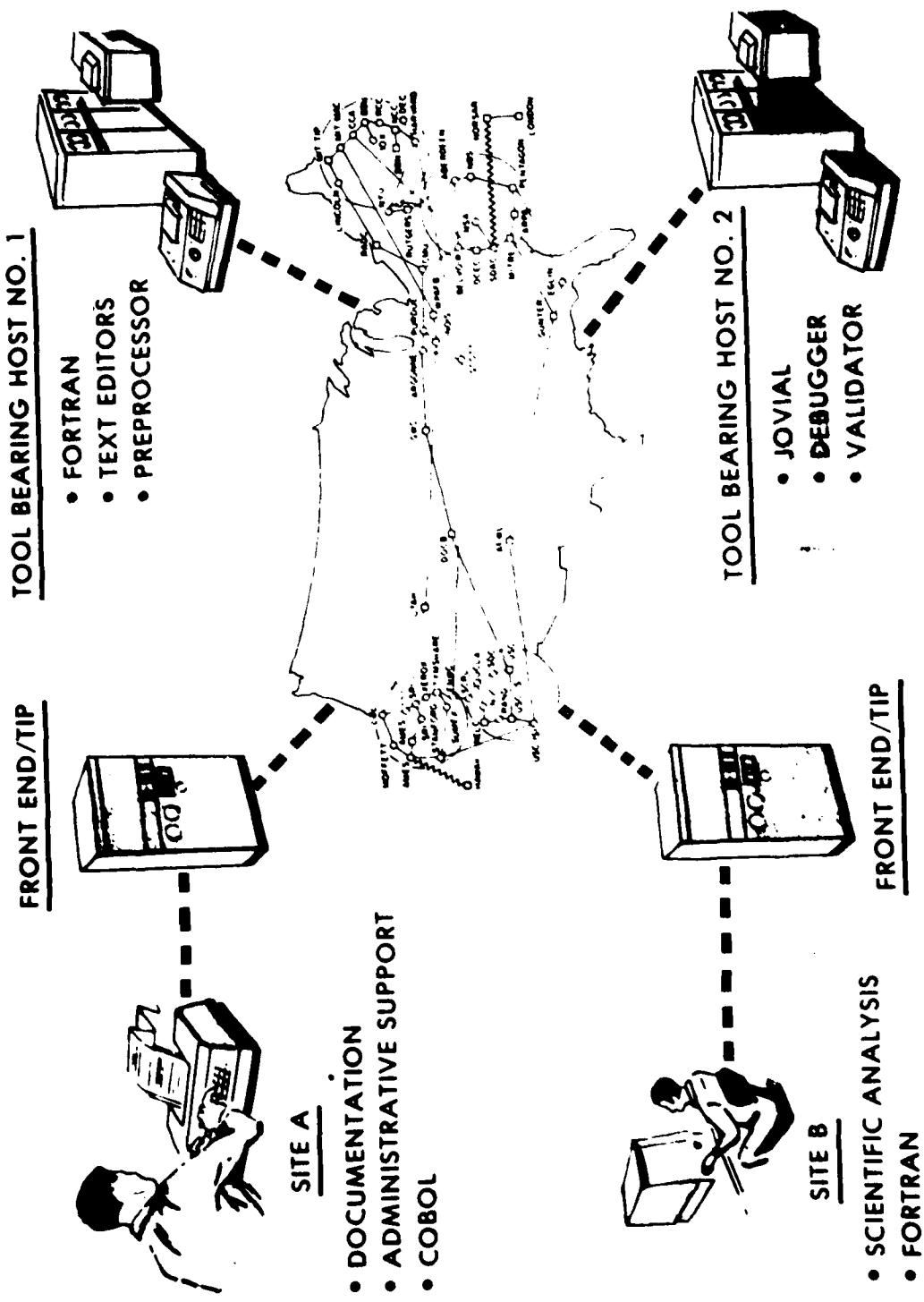
TECHNICAL APPROACH: ALGORITHM DEVELOPMENT AND DEMONSTRATION FOR:

- SEMANTIC AND SYNTACTIC PROCESS OF MESSAGES
- EXTRACTION OF DATA ELEMENTS
- CORRELATION TO AND INSERTION INTO DATABASE

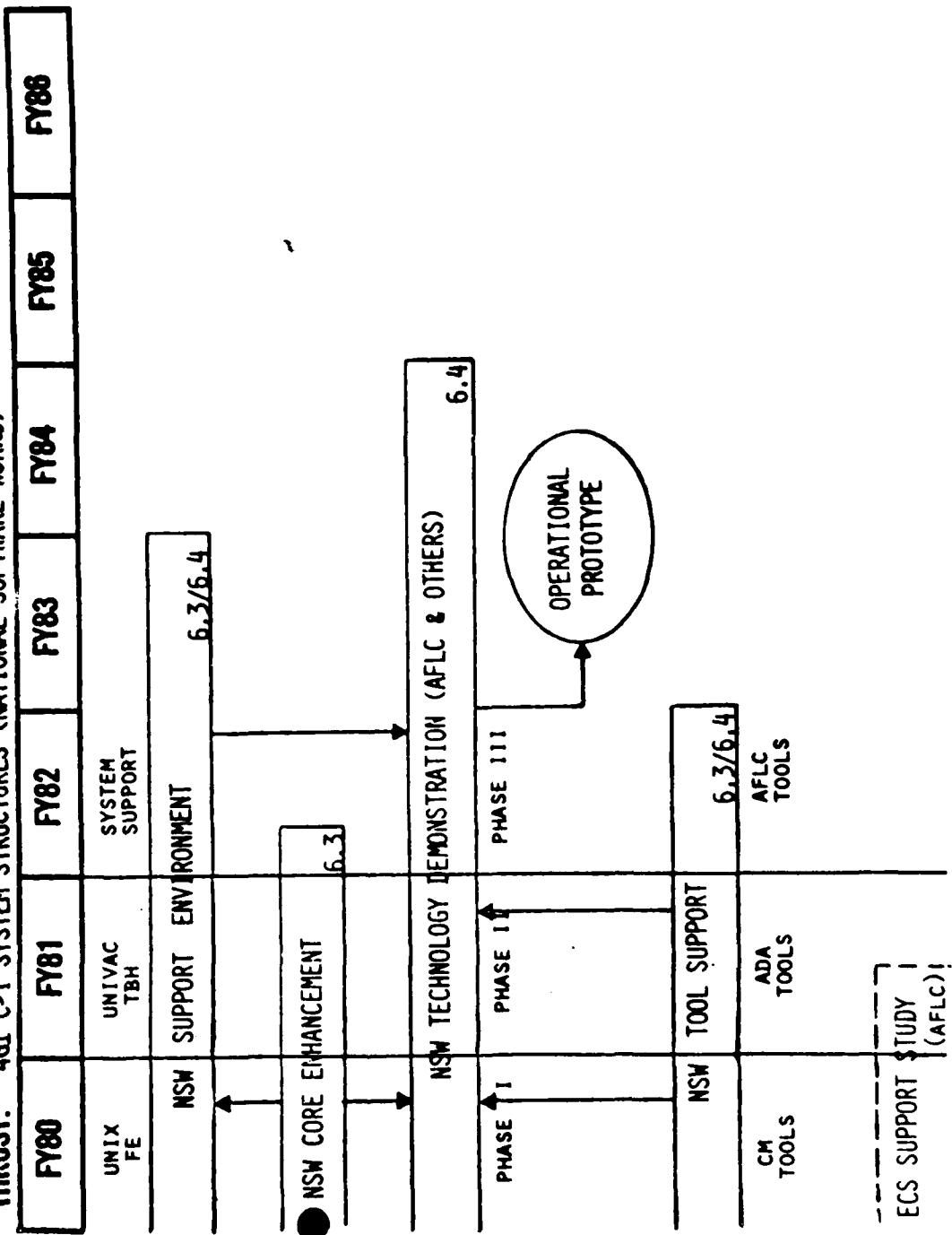
PAY-OFF: • MORE TIMELY AND COMPLETE DATABASE

- LOWER OVERHEAD IN DATA MAINTENANCE

## NATIONAL SOFTWARE WORKS



**RAUD TPO 4 TECHNOLOGY**  
**THRUST: 4GL C3I SYSTEM STRUCTURES (NATIONAL SOFTWARE WORKS)**



AD-A088 341

HOME AIR DEVELOPMENT CENTER GRIFFISS AFB, NY  
INDUSTRY LOOKS AT RADC - 1980, VOLUME III. (U)

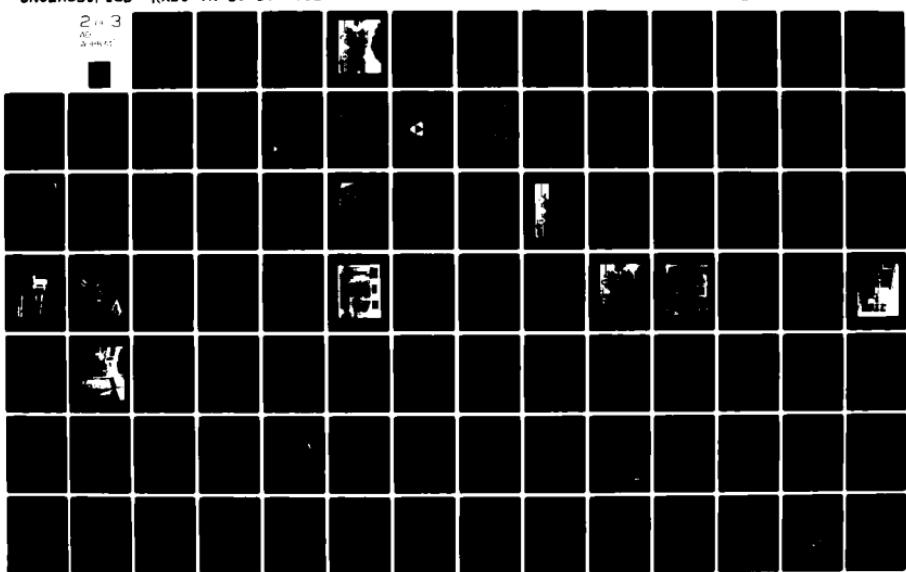
F/6 5/1

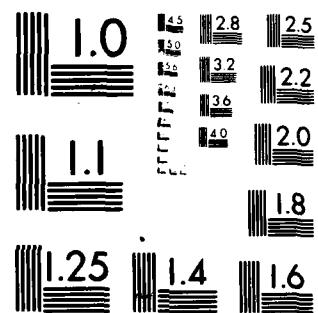
UNCLASSIFIED

1980  
RADC-TR-80-195-VOL-3

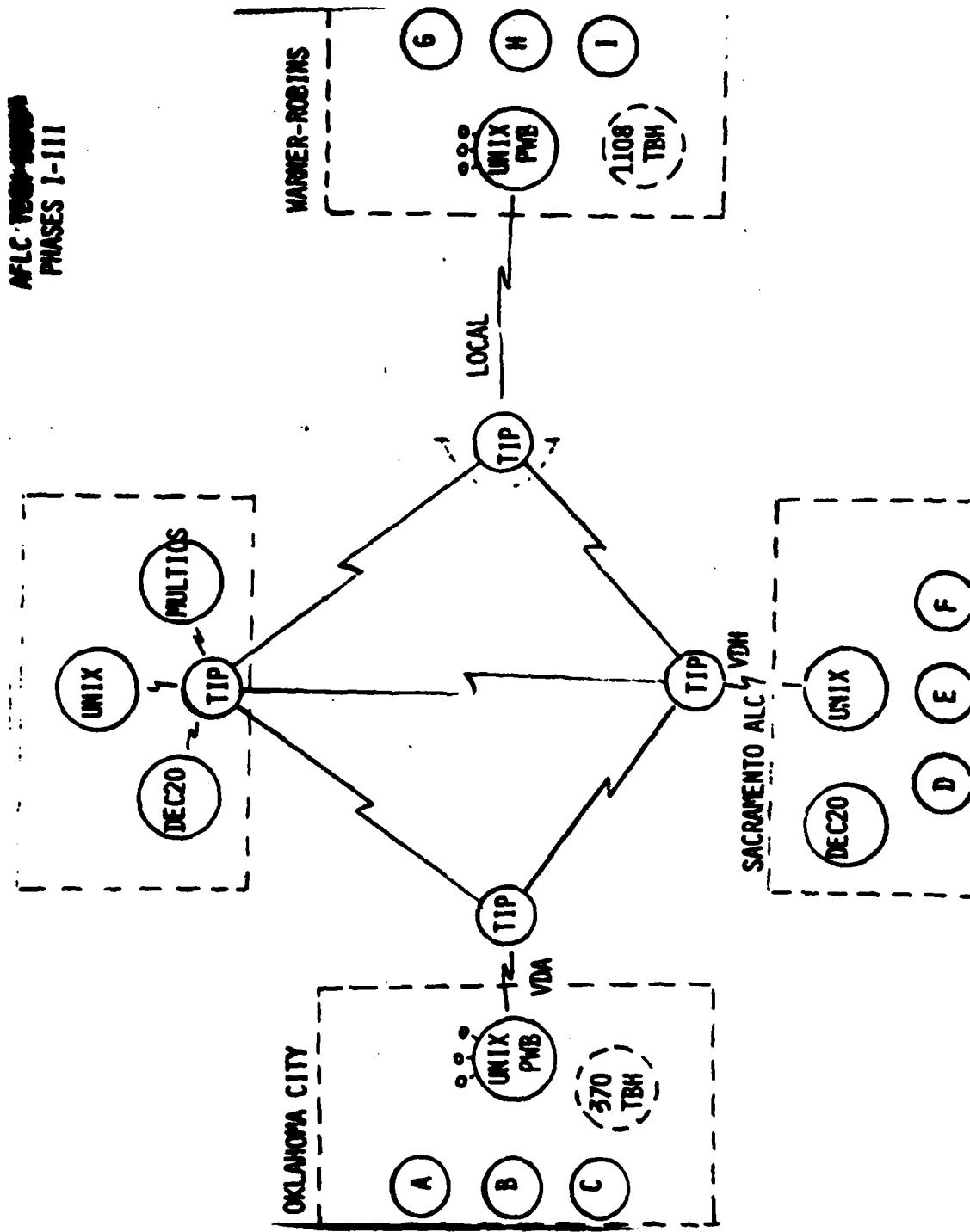
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS 1963 A



TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

THRUST/SUB-THRUST/SUB-SUB-THRUST #TITLE: 461 C3I SYSTEM STRUCTURES

BLOCK TITLE: NSW TECHNOLOGY DEMONSTRATION

OBJECTIVE: THE OBJECTIVE OF THIS EFFORT IS TO CONDUCT AN NSW TECHNOLOGY DEMONSTRATION FOR THREE AIR LOGISTICS CENTERS (ALC) WITHIN THE AIR FORCE LOGISTICS COMMAND (AFLC).

TECHNICAL APPROACH: THE EFFORT WILL BE CONDUCTED IN THREE PHASES:

- o PHASE I - ESTABLISH WARNER ROBINS ALC AS AN ARPANET NODE
  - COMPLETE PLANNING FOR OTHER SITE AND SCENARIOS
- o PHASE II - ESTABLISH OKLAHOMA CITY ALC AND SACRAMENTO ALC AS HOST
  - INTRODUCE NSW
- o PHASE III - EXECUTE FOUR APPLICATIONS SCENARIOS

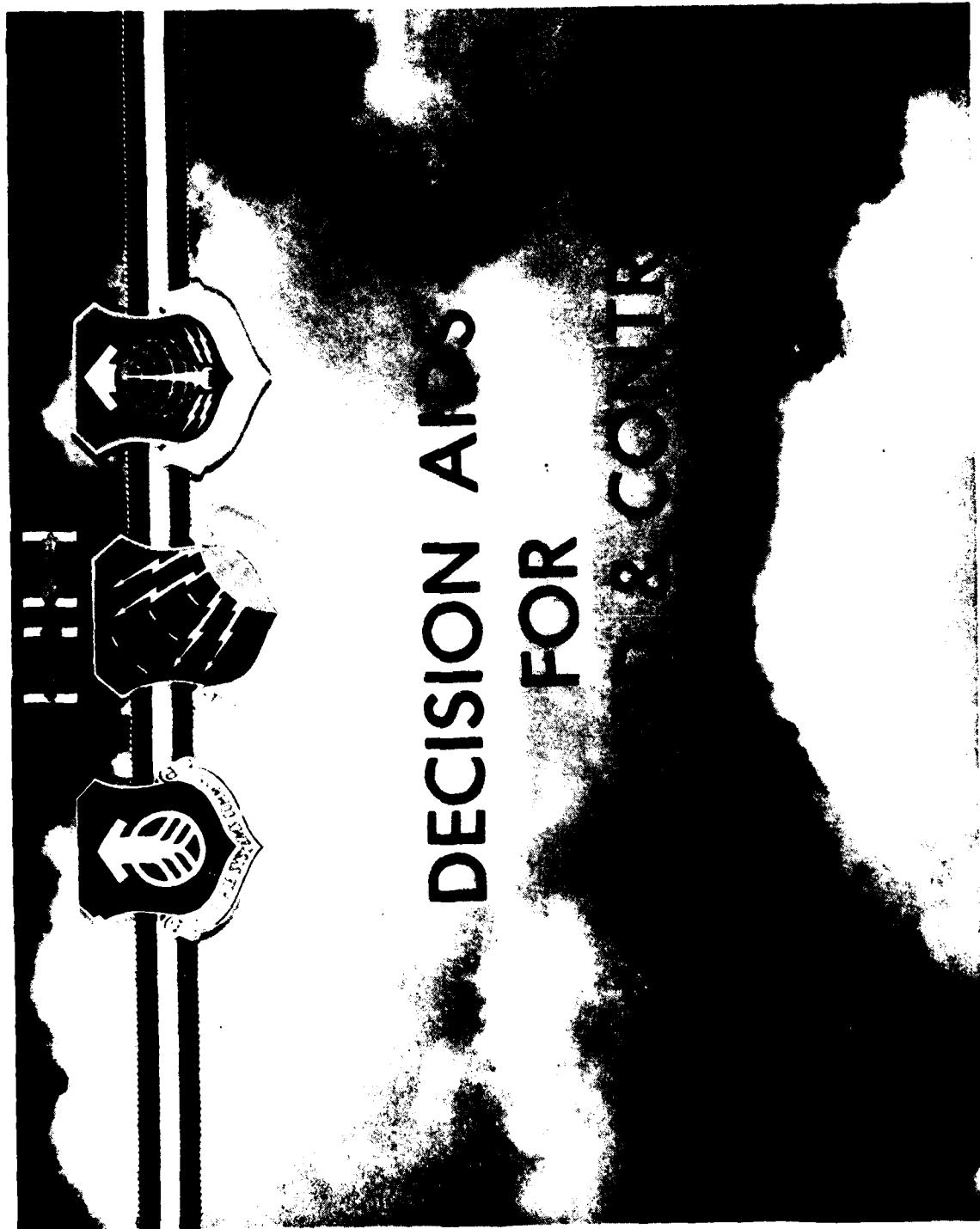
PAYOUT: MODERATE TO HIGH THROUGH:

- o SHARED RESOURCES
- o ACCESS TO NEW TOOLS
- o CONFIGURATION CONTROL OF LANGUAGES AND TOOLS

INDUSTRY LOOKS AT RADC 1980

TP0461/TP0462

<u>AREA</u>	<u>FOCAL POINT</u>	<u>SYMBOL/PHONE</u>
DISTRIBUTED OPERATING SYSTEMS	I. LAWRENCE	ISCP/7746
DISTRIBUTED DATABASES	R. METZGER	ISCP/2846
NATIONAL SOFTWARE WORKS	R. ROBINSON	ISCP/4916
MODELING/SIMULATION	Y. SMITH	ISCP/2018
TACTICAL APPLICATIONS	LT J. THOMAS	ISCP/7007
COMPUTER SECURITY	MJ T. DARR	ISCP/4013



## MAJOR GOALS OF C<sup>2</sup> DECISION AIDS

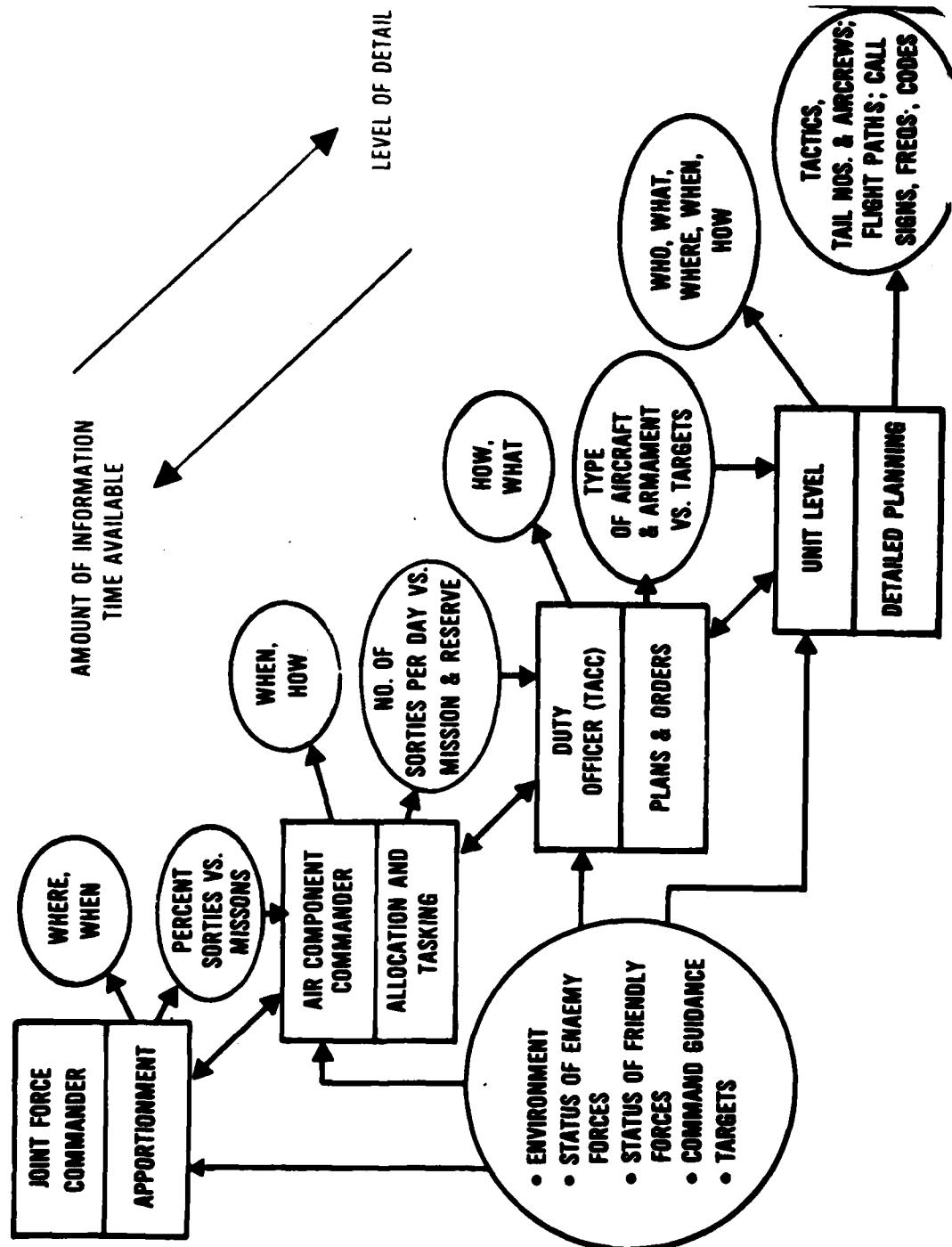
DEVELOP INTERACTIVE DECISION AIDS USING ADVANCED COMPUTER INFORMATION PROCESSING AND DISPLAY WHICH WILL ASSIST THE DECISION MAKER TO:

- ASSESS WHAT WILL HAPPEN IN UNCERTAIN ENVIRONMENTS
- USE AND COMBINE INFORMATION
- APPLY INFERENCE, PREDICTION AND DIAGNOSIS
- EVALUATE WORTH OF OBJECTS
- WEIGH RISKS AGAINST BENEFITS

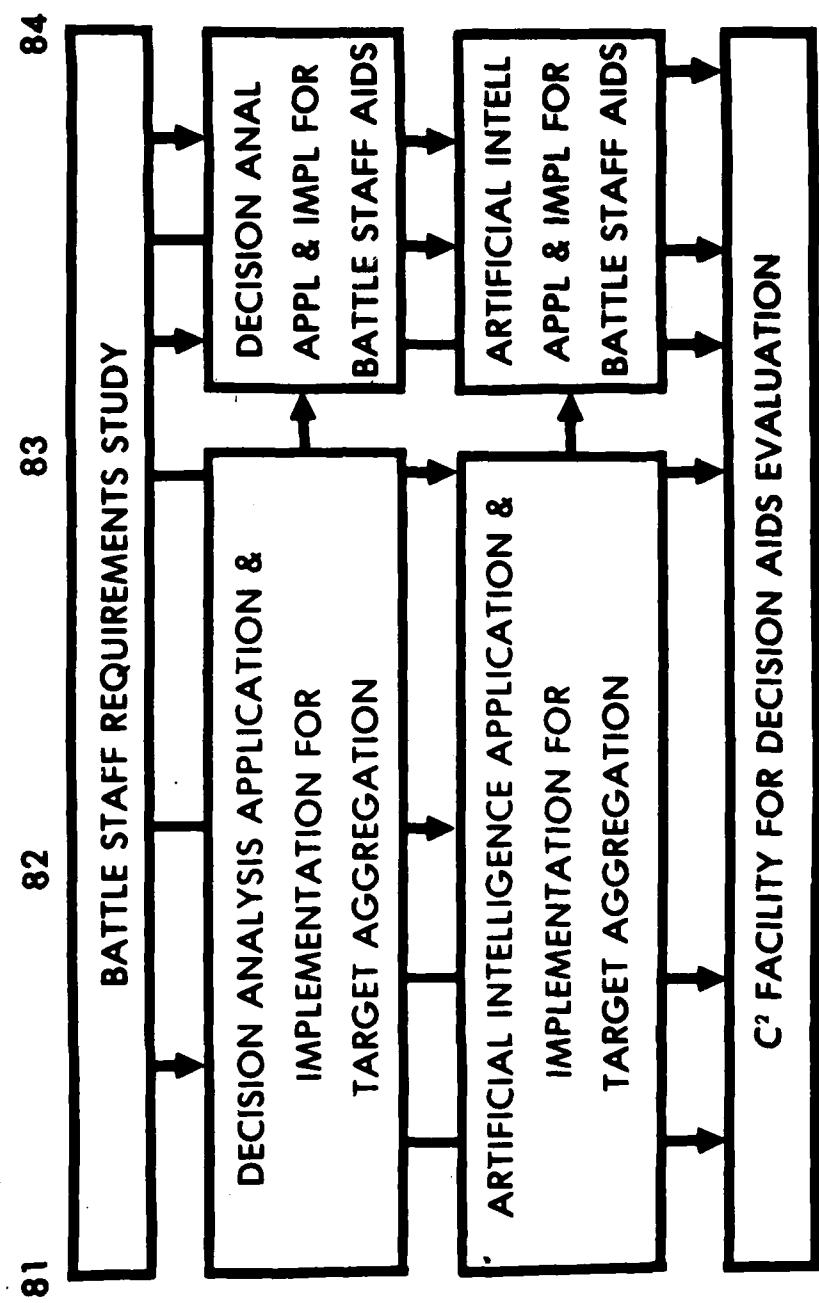
## TECHNOLOGY BASE FOR C<sup>2</sup> DECISION-MAKING

- AUTOMATED DECISION AIDS
- KNOWLEDGE-BASED SYSTEMS
- NATURAL LANGUAGES
- MODELLING
- HUMAN PROCESSES IN DECISION-MAKING

## LEVELS OF DECISION-MAKING



## C<sup>2</sup> DECISION AIDS



## STUDY OF BATTLE STAFF REQUIREMENTS FOR DECISION AIDS

### DATA COLLECTION

- INTERVIEWS WITH KEY STAFF PEOPLE
- DOCUMENTATION REVIEW
- OBSERVATIONS

### ANALYSIS

- IDENTIFICATION OF DECISION-MAKING PROCESS
- CHARACTERIZATION OF DECISION-MAKING PROCESS

### EVALUATION

- DETERMINATION OF OPPORTUNITIES FOR IMPROVEMENT
- DETERMINATION OF UTILITY OF DECISION AIDS
- RECOMMENDATION OF APPLICATION EFFORTS

## **DECISION AIDS FOR TARGET AGGREGATION**

### **STUDY & ANALYSIS OF FUNCTIONAL APPLICATIONS**

### **APPLICATION & IMPLEMENTATION OF DECISION AIDS ON SELECTED FUNCTIONAL APPLICATIONS**

### **FEASIBILITY DEMO & EVALUATION OF DECISION AID APPLICATIONS**

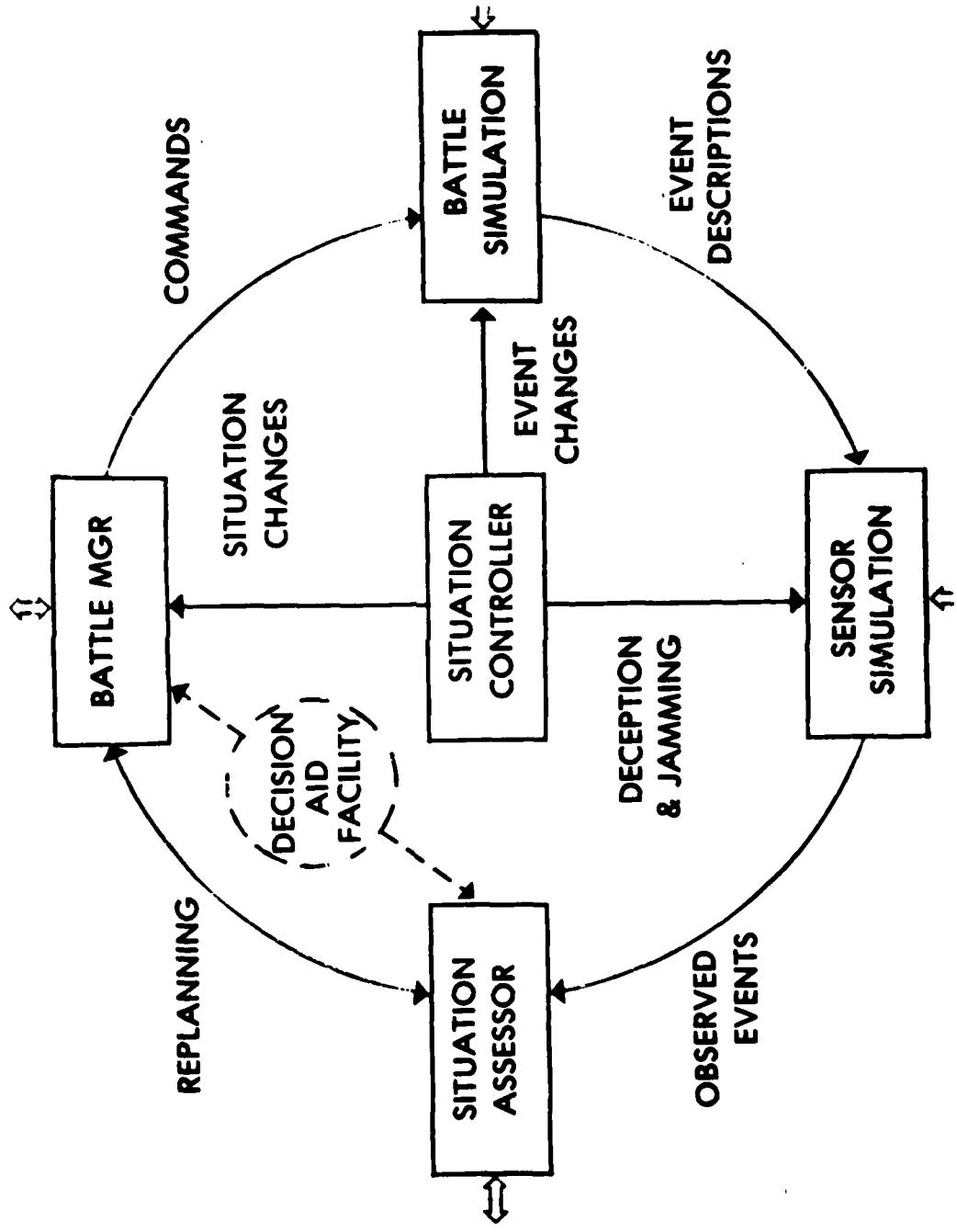
### **DECISION AIDS TECHNOLOGY**

- DECISION ANALYSIS
- ARTIFICIAL INTELLIGENCE

### **INTERACT WITH OTHER CONTRACTORS**

- BATTLE STAFF REQUIREMENTS STUDY
- C<sup>3</sup> FACILITY FOR DECISION AIDS

## TEST BED FUNCTIONS



## TEST BED REQUIREMENTS

- TEST AND EVALUATE CONCEPTS
- DEMONSTRATE CAPABILITIES IN ENVIRONMENT COMPARABLE TO USERS
- INTERACTION WITH USERS  
    TRANSFERABILITY
- PROVIDE REALISTIC ADP ENVIRONMENT TO CONTRACTORS
- MAINTAIN SOFTWARE CONFIGURATION CONTROL

**PLANNED RADC PROGRAM, FY 81**

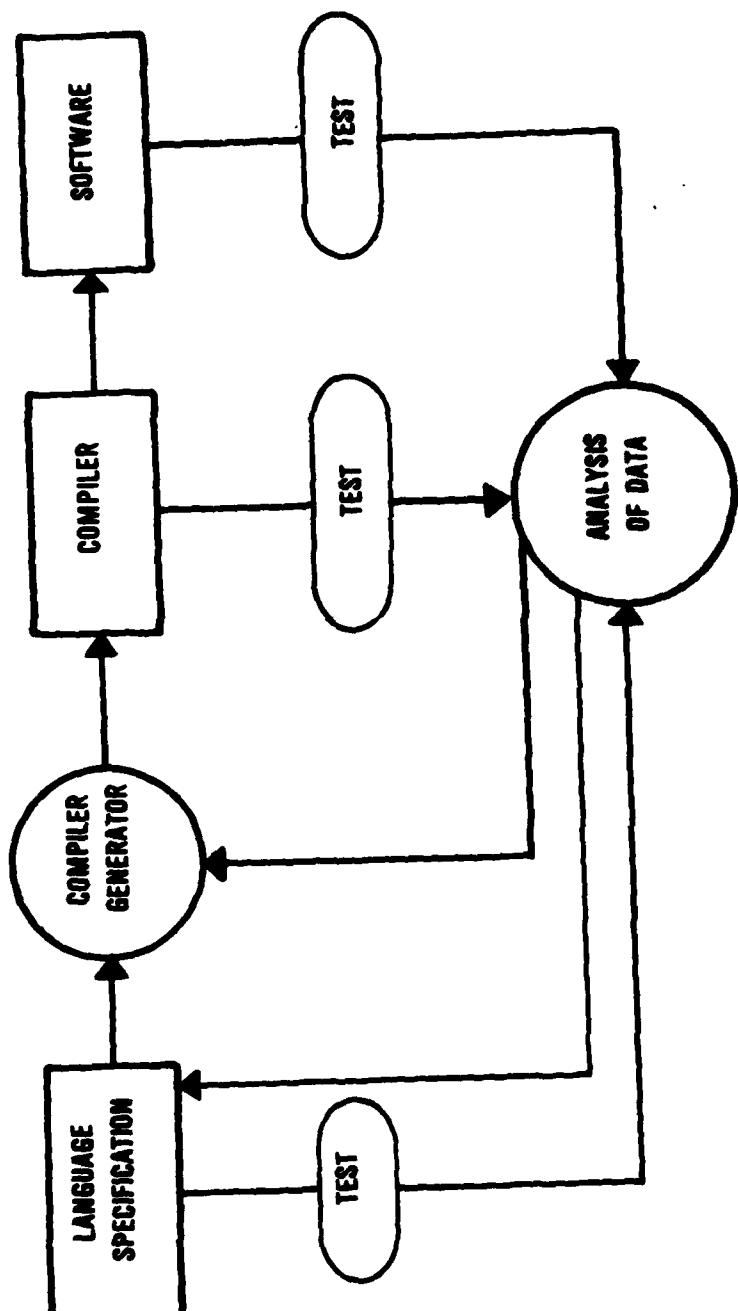
**APPLICATIONS OF DECISION AIDS TO TARGET AGGREGATION**

**STUDY OF BATTLE STAFF REQUIREMENTS FOR DECISION AIDS**

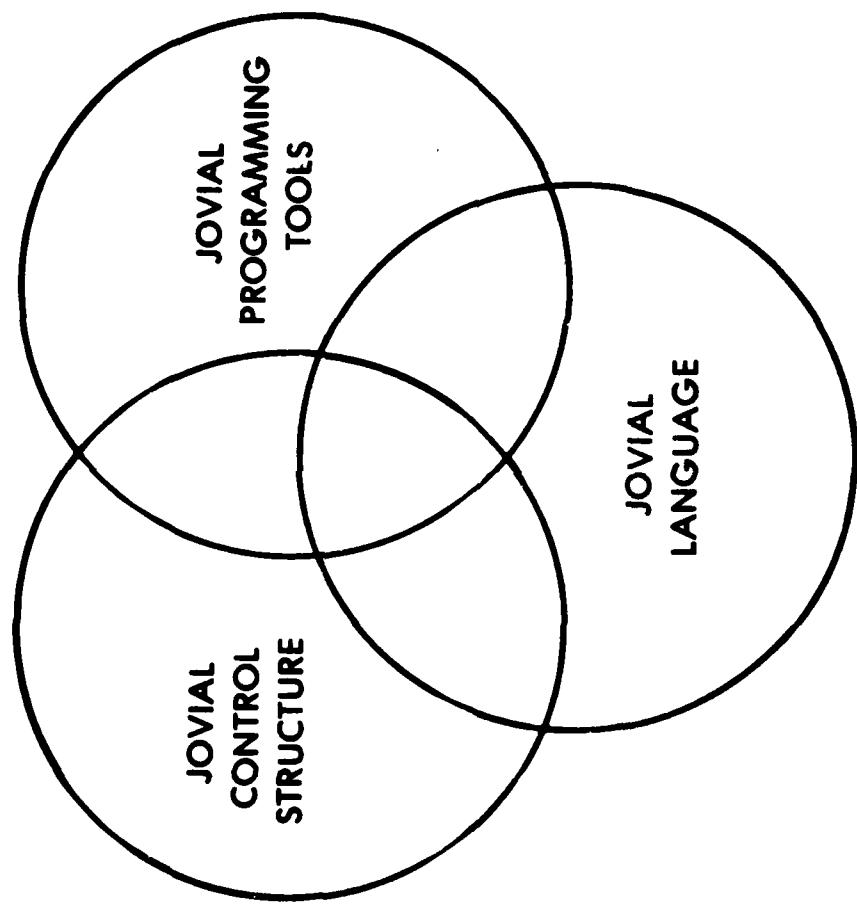
**C<sup>2</sup> FACILITY FOR DECISION AIDS EVALUATION**

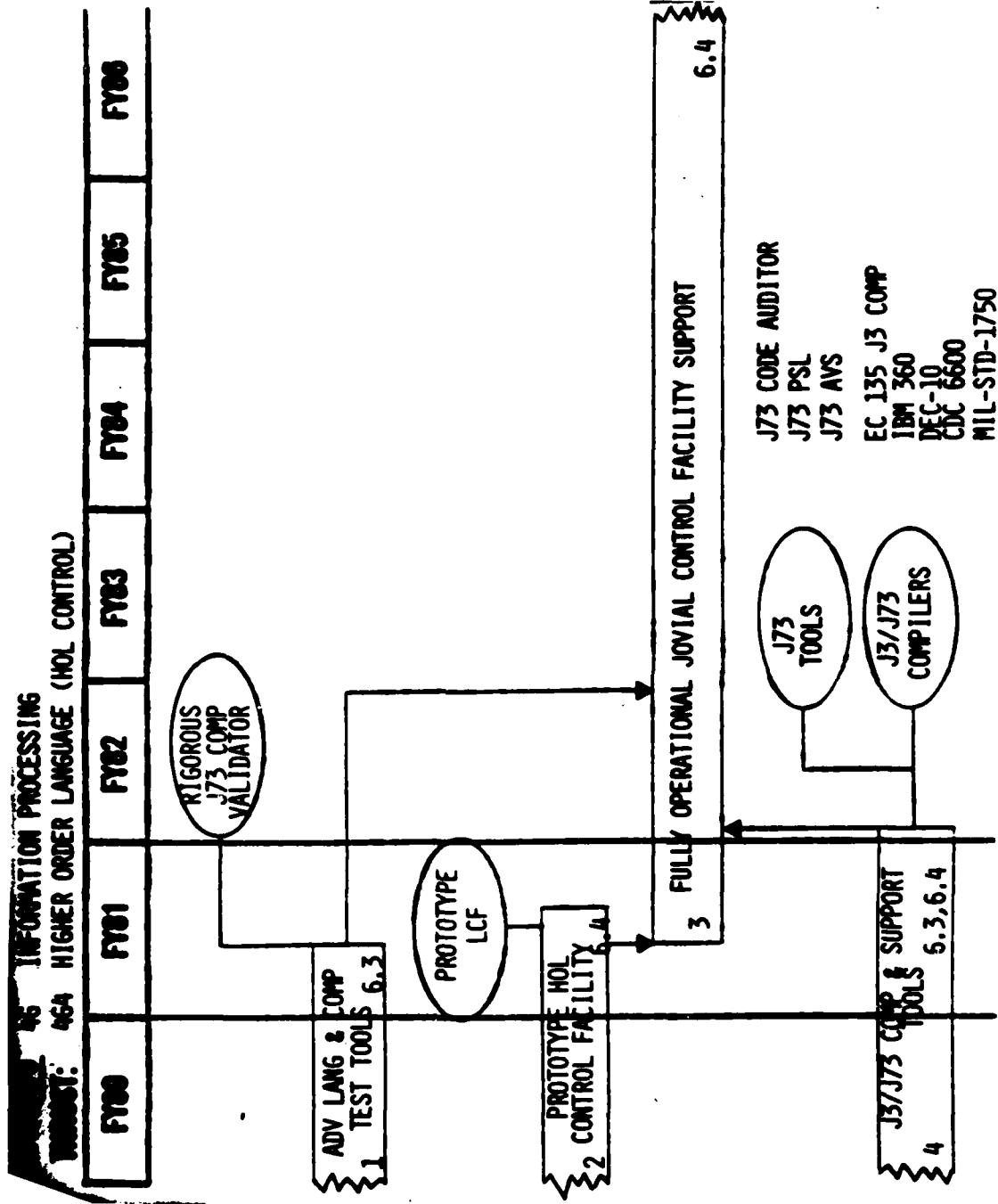
S. A. DINITTO, JR.  
SOFTWARE SCIENCES SECTION  
ISIS/3851

## SOFTWARE TOOLS & PROCEDURES FOR A CONTROL CENTER

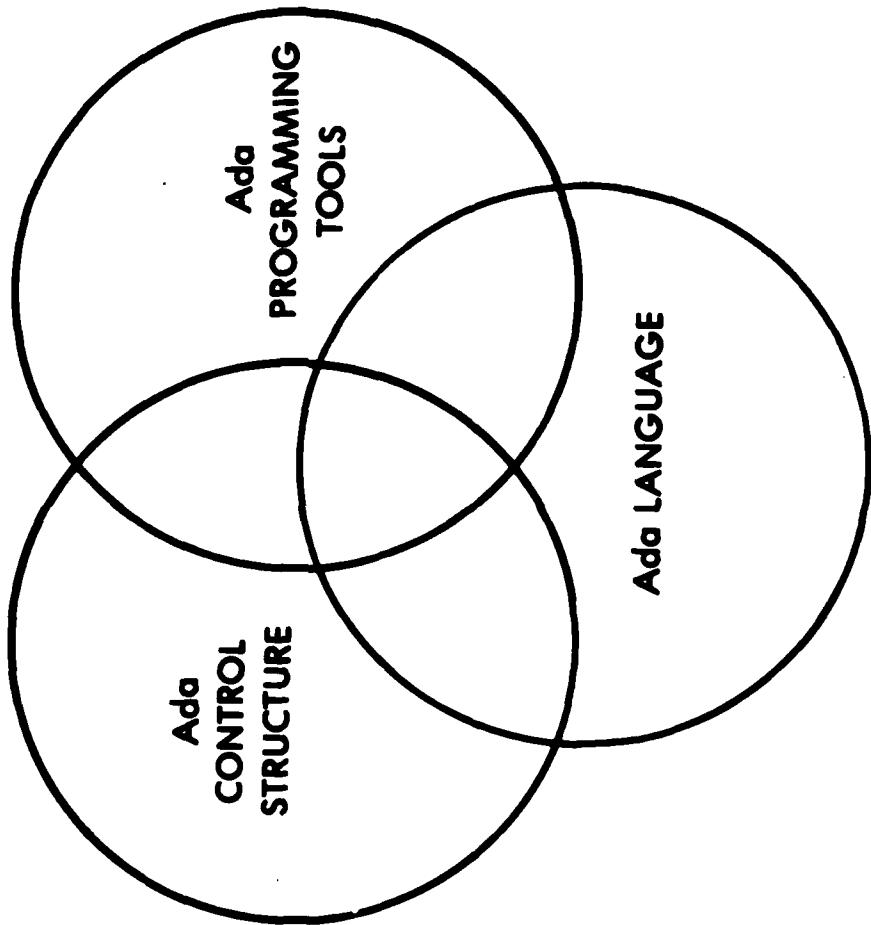


## JOVIAL PROGRAMMING ENVIRONMENT

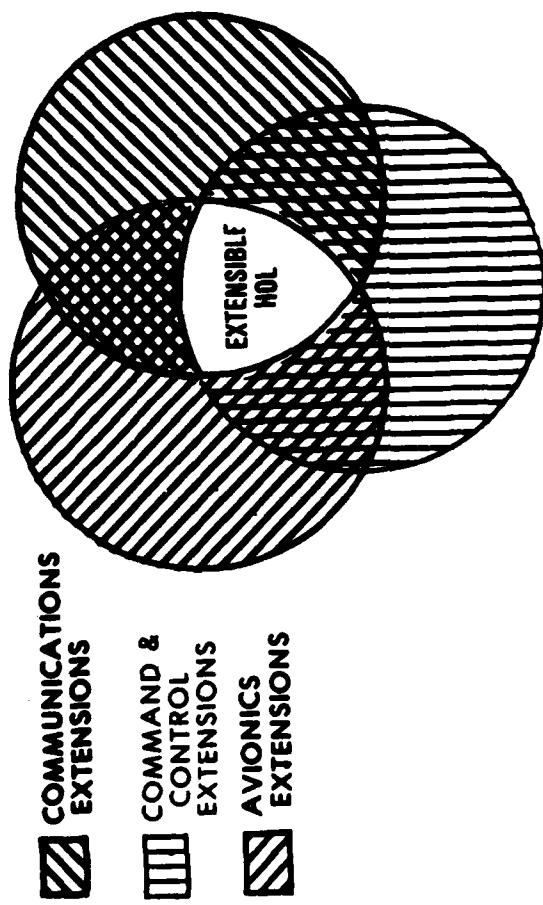




## Ada (DOD-1) PROGRAMMING ENVIRONMENT



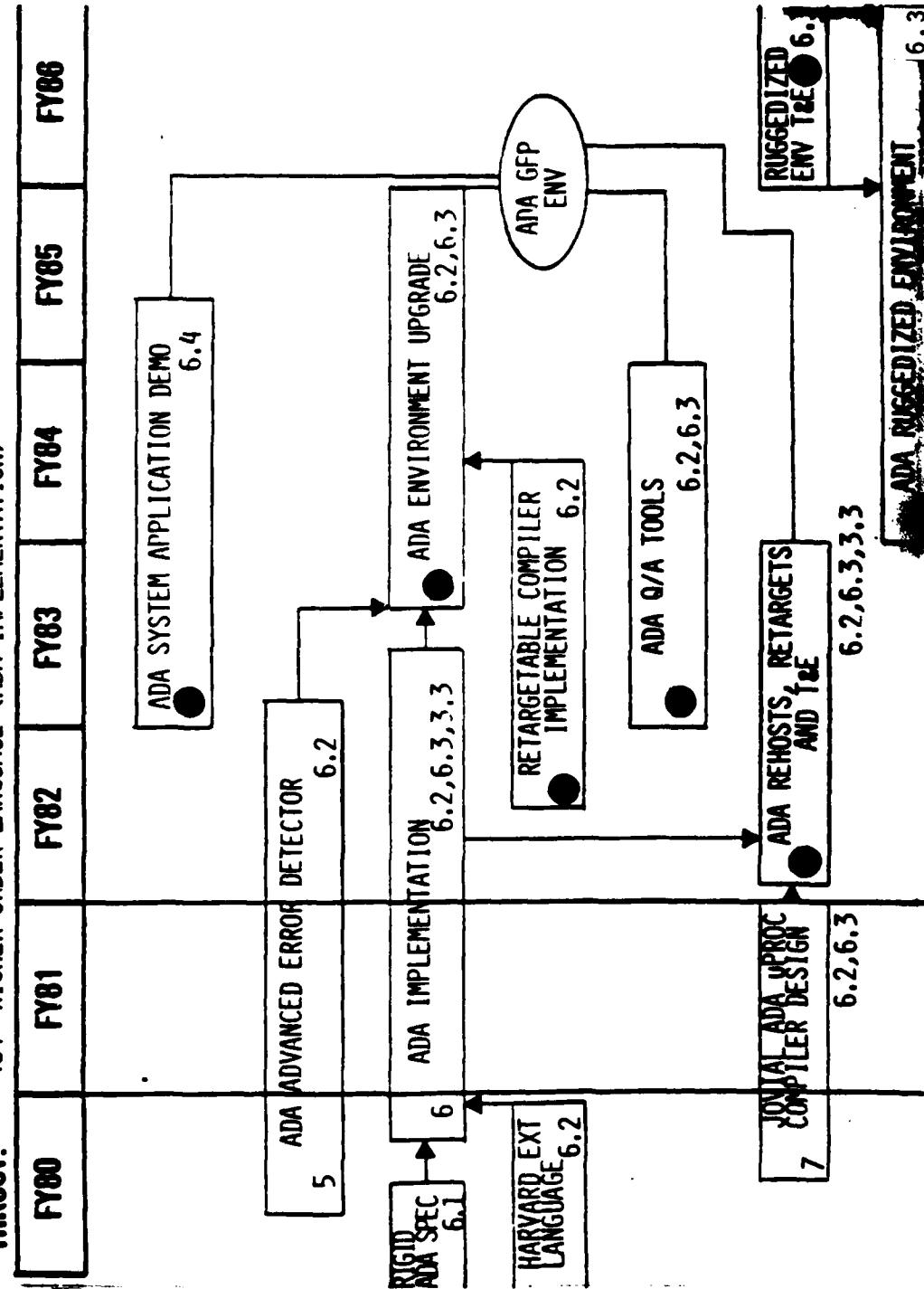
## EXTENSIBLE HOL vs APPLICATIONS



- SMALL "CORE" LANGUAGE - COMMON TO "ALL" APPLICATIONS
- "CORE" CAN BE EXTENDED TO MEET REQUIREMENTS — WITHOUT MODIFYING COMPILER
- EACH APPLICATION CAN HAVE ITS OWN UNIQUE EXTENSIONS — NOBODY PAYS FOR "UNUSED GENERALITY"
- AS NEW APPLICATIONS ARE ADDED, EACH GAINS FROM PREVIOUS INVESTMENTS
  - COMPILERS
  - SUPPORT TOOLS
  - TRAINING
  - APPLICATION DEPENDENT SOFTWARE LIBRARIES

CONTINUED

**RADC 190** 4G INFORMATION PROCESSING  
**THINBIST** 4G/HIGHER ORDER LANGUAGE (ADA IMPLEMENTATION)



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

EFFORT BLOCK TITLE: ADA ENVIRONMENT UPGRADE

OBJECTIVE: UPGRADE QUALITY, CURRENCY, CAPABILITY OF THE ADA ENVIRONMENT

TECHNICAL APPROACH: • IMPLEMENT CORRECTIONS

- IMPLEMENT LANGUAGE CHANGES
- IMPLEMENT OPTIMIZATIONS
- INTEGRATE ADVANCED ERROR DETECTOR

PAY OFF: COMPILER WILL CONFORM TO LATEST ADA SPEC, ENVIRONMENT ENHANCED

1. ST #/TITLE: 46 HIGH-QUALITY ADA PROCESSING  
2. ST #/TITLE: 464 HIGH-QUALITY LANGUAGE ADA IMPLEMENTATION  
3. ST #/TITLE: FLEXIBLE COMPUTER IMPLEMENTATION  
4. ST #/TITLE: SEMI-AUTOMATICALLY GENERATE HIGH-QUALITY ADA COMPILER CODE GENERATORS

TECHNICAL APPROACH: • WORK FROM COMPUTER DESCRIPTION LANGUAGE  
• CAPITALIZE ON STD COMPILER FRONT-END

BY CFF: REDUCED COST OF COMPILERS, ADA MORE READILY AVAILABLE

TP0/THRUST #/TITLE: 46 INFORMATION PROCESSING  
SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)  
EFFORT BLOCK TITLE: ADA Q/A TOOLS  
OBJECTIVE: DEVELOP SOPHISTICATED Q/A TOOLS FOR USE WITH ADA.  
TECHNICAL APPROACH: . AUTOMATED VERIFICATION SYSTEM  
                          . QUALITY METRICS MEASUREMENT  
ADVANTAGE: LOWER TEST COSTS, FEWER INDIVIDUAL TESTERS, ETC.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING  
SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADA IMPLEMENTATION)  
EFFORT BLOCK TITLE: ADA REHOST, RETARGETS, AND TEST AND EVALUATION  
OBJECTIVE: FURTHER PREPARE AND CHECK OUT ADA ENVIRONMENT FOR GFE

TECHNICAL APPROACH: REHOST/RETARGET ADA ENVIRONMENT  
- DEC-10, CDC6600, 1750A, DIS  
TEST ADA UNDER APPLICATIONS CONDITIONS  
- AVIONICS, ARMAMENTS, COMMUNICATIONS

PAY OFF: ALLOWS EARLY REQUIRED USE OF ADA ON AIR FORCE CONTRACTS

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

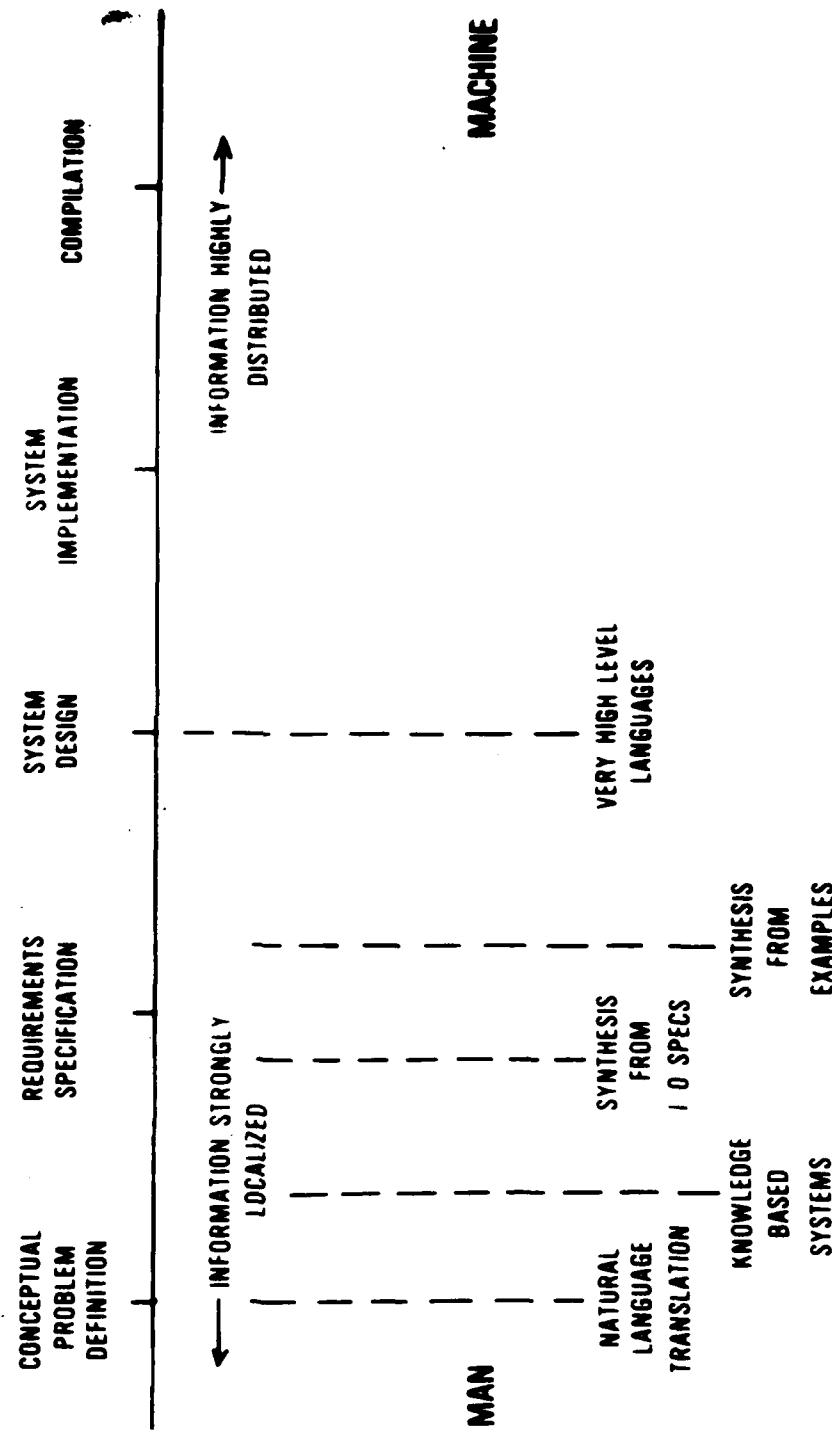
EFFORT BLOCK TITLE: ADA SYSTEM APPLICATION DEMO

OBJECTIVE: "NATURE" THE ADA INTEGRATED ENVIRONMENT

TECHNICAL APPROACH: . CANDIDATE SYSTEM APPLICATIONS PROVIDED BY PRODUCT DIVISIONS  
. ENVIRONMENT IMPLEMENTED FOR SELECTED SYSTEM

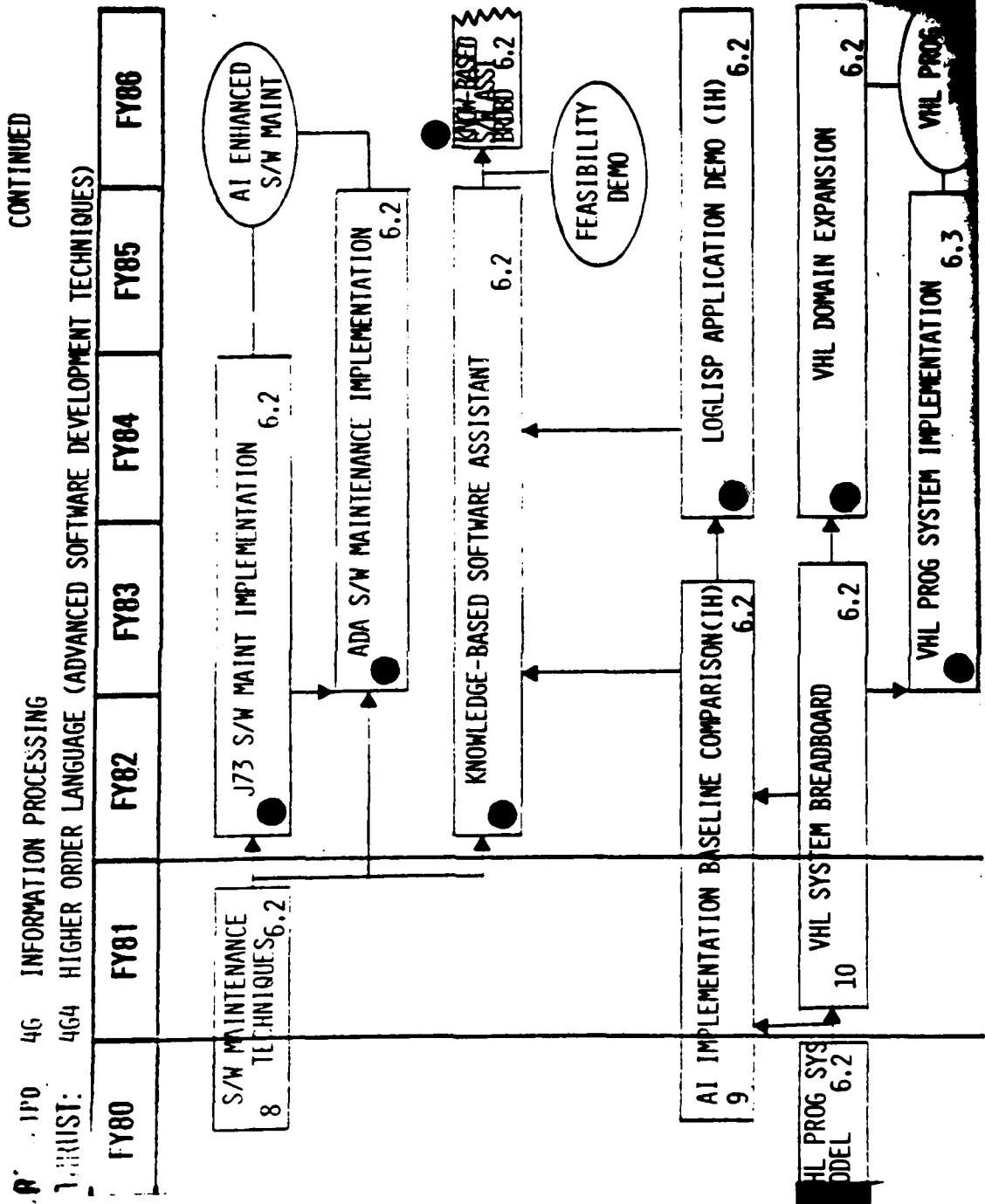
PAY OFF: ADA PROVEN OUT, AVAILABLE ON MORE SYSTEMS

## MAN-MACHINE INTERFACES



1.0 46 INFORMATION PROCESSING

CONTINUED



TFD/THRUST #/TITLE: 46 INFORMATION PROCESSING  
SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

EFFORT BLOCK TITLE: J73 SOFTWARE MAINTENANCE IMPLEMENTATION

OBJECTIVE: IMPLEMENT TOOLS TO TAKE OVER TEDIOUS, ROUTINE "MAINTENANCE" TASKS

TECHNICAL APPROACH: USE APPLICABLE ARTIFICIAL INTELLIGENCE TECHNOLOGY

- THEOREM PROVING
- FLOW ANALYSIS
- COMPILER OPTIMIZATION

END-USE: REDUCED MAINTENANCE COSTS

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING  
SUB-THRUST #/TITLE: 46A HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)  
EFFORT BLOCK TITLE: ADA SOFTWARE MAINTENANCE IMPLEMENTATION  
OBJECTIVE: IMPLEMENT "MAINTENANCE" TOOLS FOR ADA  
TECHNICAL APPROACH: USE APPLICABLE ARTIFICIAL INTELLIGENCE TECHNOLOGY  
BUILD ON J73 SOFTWARE MAINTENANCE IMPLEMENTATION  
PAY OFF: REDUCED MAINTENANCE COSTS

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 4C4 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

EFFORT BLOCK TITLE: KNOWLEDGE-BASED SOFTWARE ASSISTANT

OBJECTIVE: INTERACTIVE AID TO INTELLIGENTLY ASSIST ALL PHASES OF SOFTWARE LIFE CYCLE

TECHNICAL APPROACH:

- FORMALIZE "EXPERT" KNOWLEDGE
- EMBODY "EXPERTISE" IN KNOWLEDGE-BASED SYSTEM
- ITERATIVELY REFINEx

PAY OFF: LOWER LIFE CYCLE COSTS

- MINIMIZE INTEGRATION PROBLEMS
- CORPORATE MEMORY OF ALL LIFE CYCLE DECISIONS
- MINIMIZE IMPACT OF PERSONNEL CHANGES

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

EFFORT BLOCK TITLE: VHL PROG SYSTEM IMPLEMENTATION

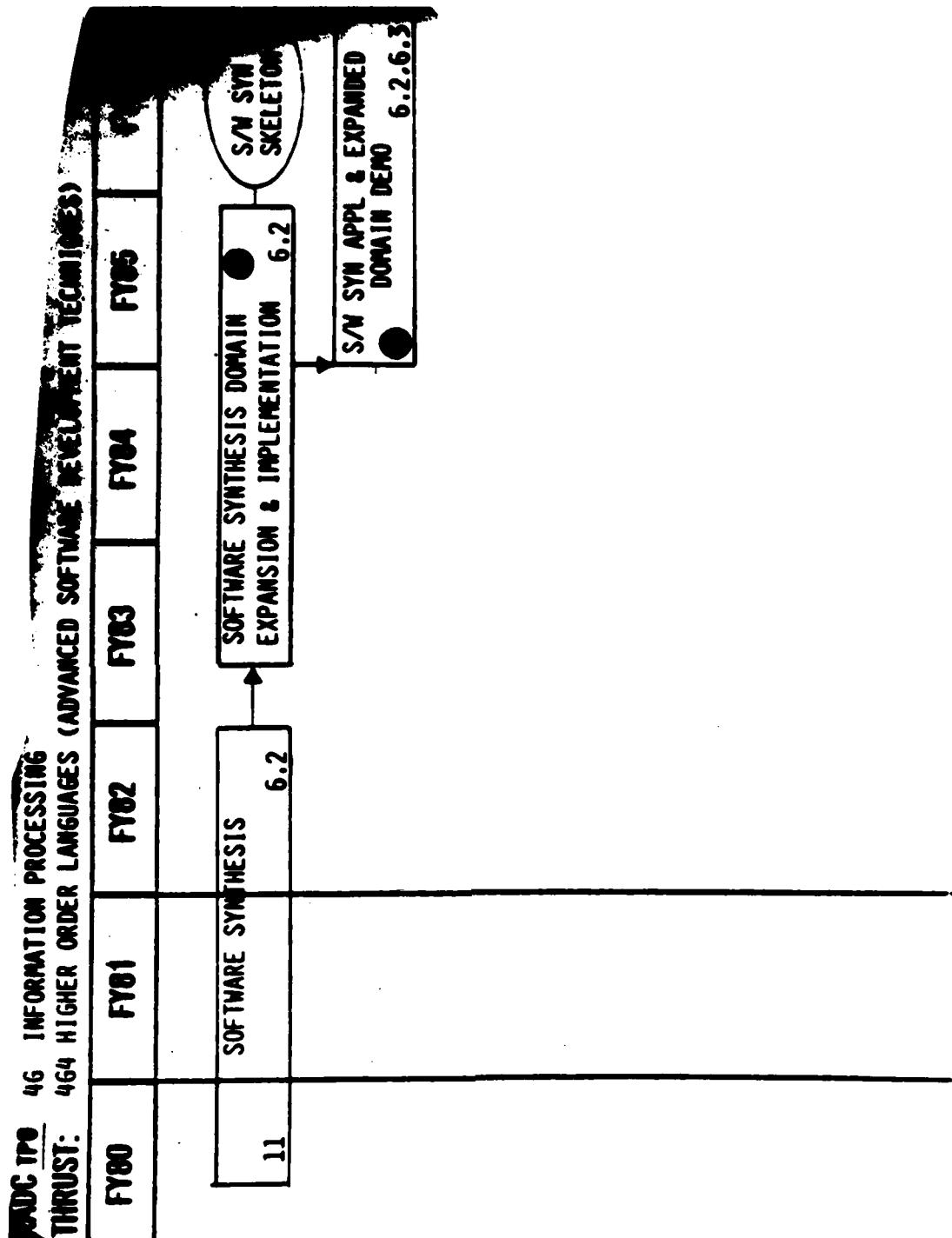
OBJECTIVE: HIGHER LEVEL COMMUNICATION LANGUAGE BETWEEN HUMAN AND COMPUTER

TECHNICAL APPROACH: . MODIFY AND EXTEND LOGLISP SYSTEM

- MORE POWERFUL KNOWLEDGE BASE
- INCREASE EFFICIENCY
- IMPROVE USER INTERFACE

PAY OFF: INCREASE PROGRAMMER PRODUCTIVITY IN ALL LIFE CYCLE PHASES

ADC TR 46 INFORMATION PROCESSING  
THRUST: 464 HIGHER ORDER LANGUAGES (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)



TP0/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

EFFORT BLOCK TITLE: SOFTWARE SYNTHESIS DOMAIN EXPANSION & IMPLEMENTATION

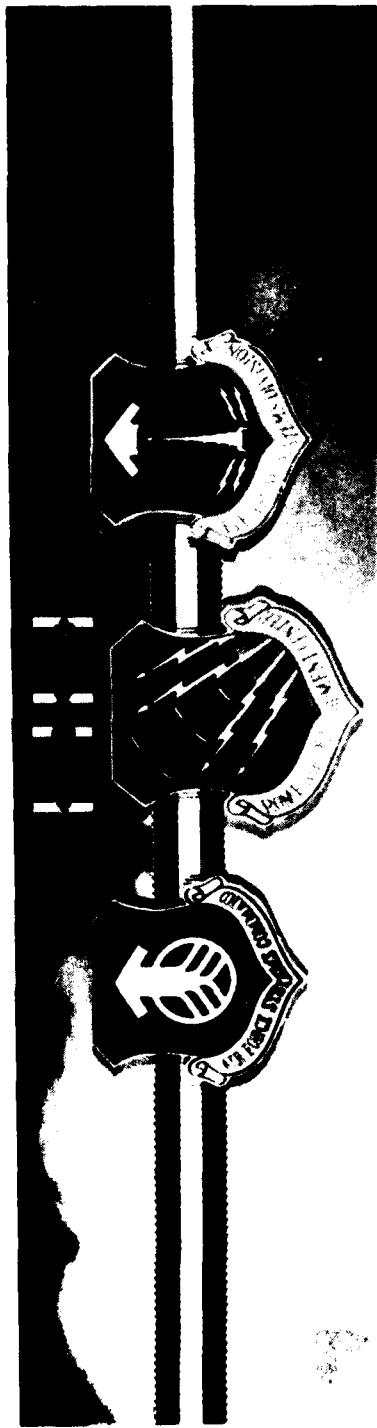
OBJECTIVE: GENERATE SOFTWARE FROM HIGH LEVEL SPECIFICATIONS

TECHNICAL APPROACH: . SYNTHESIS FROM I/O SPECIFICATIONS (MANNA & WALDINGER)  
. SELECT MEANINGFUL APPLICATION DOMAIN

PAY OFF: REDUCE SCOPE OF LABOR INTENSIVE AND ERROR-PRONE ASPECTS OF SOFTWARE:  
CODING, TESTING, MAINTENANCE

INDUSTRY LOOKS AT RADC 1980  
HIGHER ORDER LANGUAGES  
TP0464

<u>AREA</u>	<u>PROGRAM MANAGER</u>	<u>SYMBOL/PHONE</u>
HOL CONTROL	RICHARD SLAVINSKI	ISIS/2748
ADA IMPLEMENTATION	DONALD ROBERTS	ISIS/4325
ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES	DOUGLAS WHITE	ISIS/7010



## WIDEBAND RECORDING

PRESENTED BY:

ALBERT A. JAMBERDINO

TPO/THRUST: RECONNAISSANCE AND INTELLIGENCE

SUB-THRUST: WIDEBAND RECORDING

PROGRAM GOALS: TO DEVELOP THE NECESSARY ANALOG AND DIGITAL DATA RECORDING, TECHNOLOGIES TO INSURE THE PROPER COLLECTION, PROCESSING, STORAGE AND DISSEMINATION OF EXTREMELY HIGH DATA RATE INTELLIGENCE INFORMATION.

TECHNICAL AREAS: MAGNETIC, ELECTRON BEAM, OPTICAL DISK, CONVENTIONAL LASER, AND LASER HOLOGRAPHIC

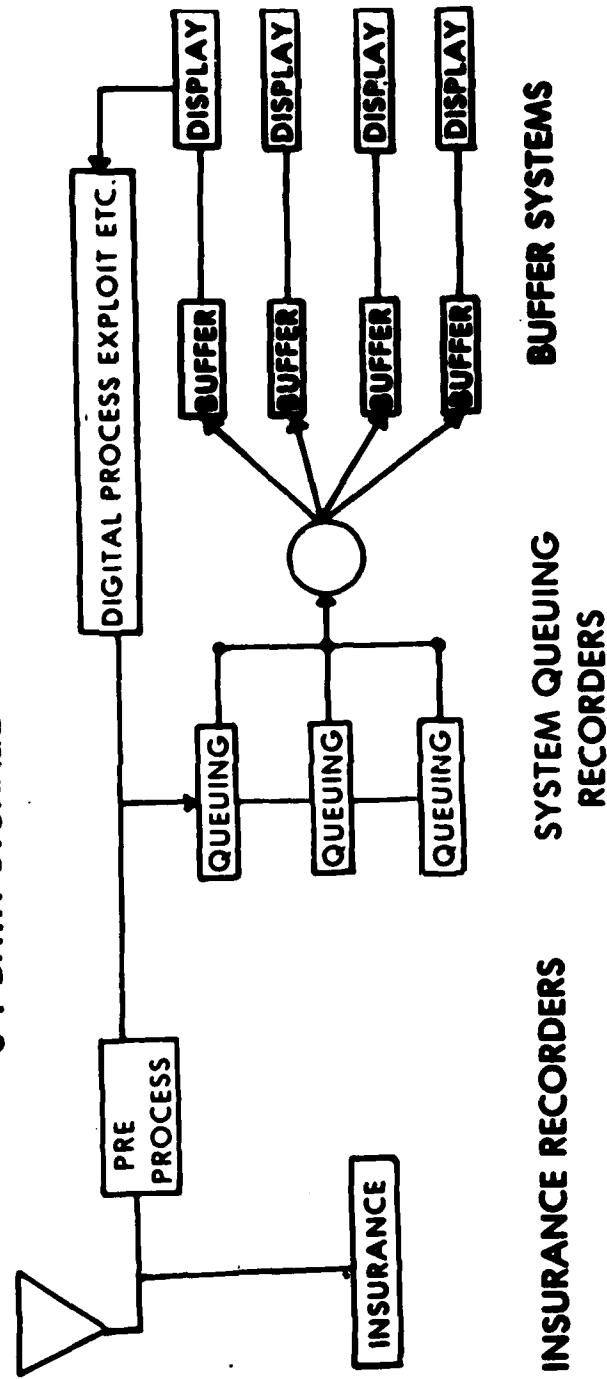
PROGRAMS

FUNDING  
(IN THOUSANDS)

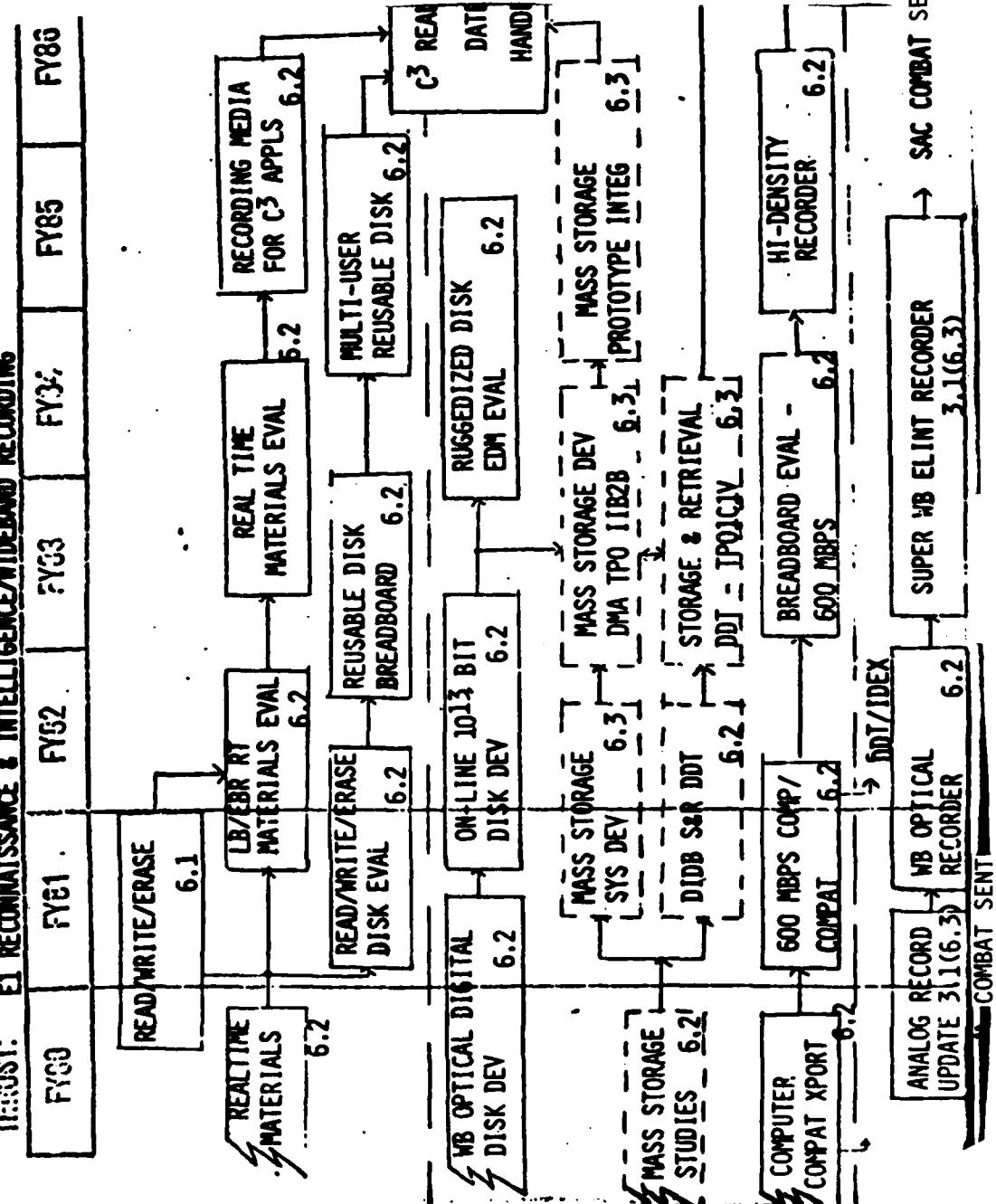
<u>FY81 - FY86</u>
6 1 450
6 2 4000
6 3 6000

## WIDE BAND RECORDING

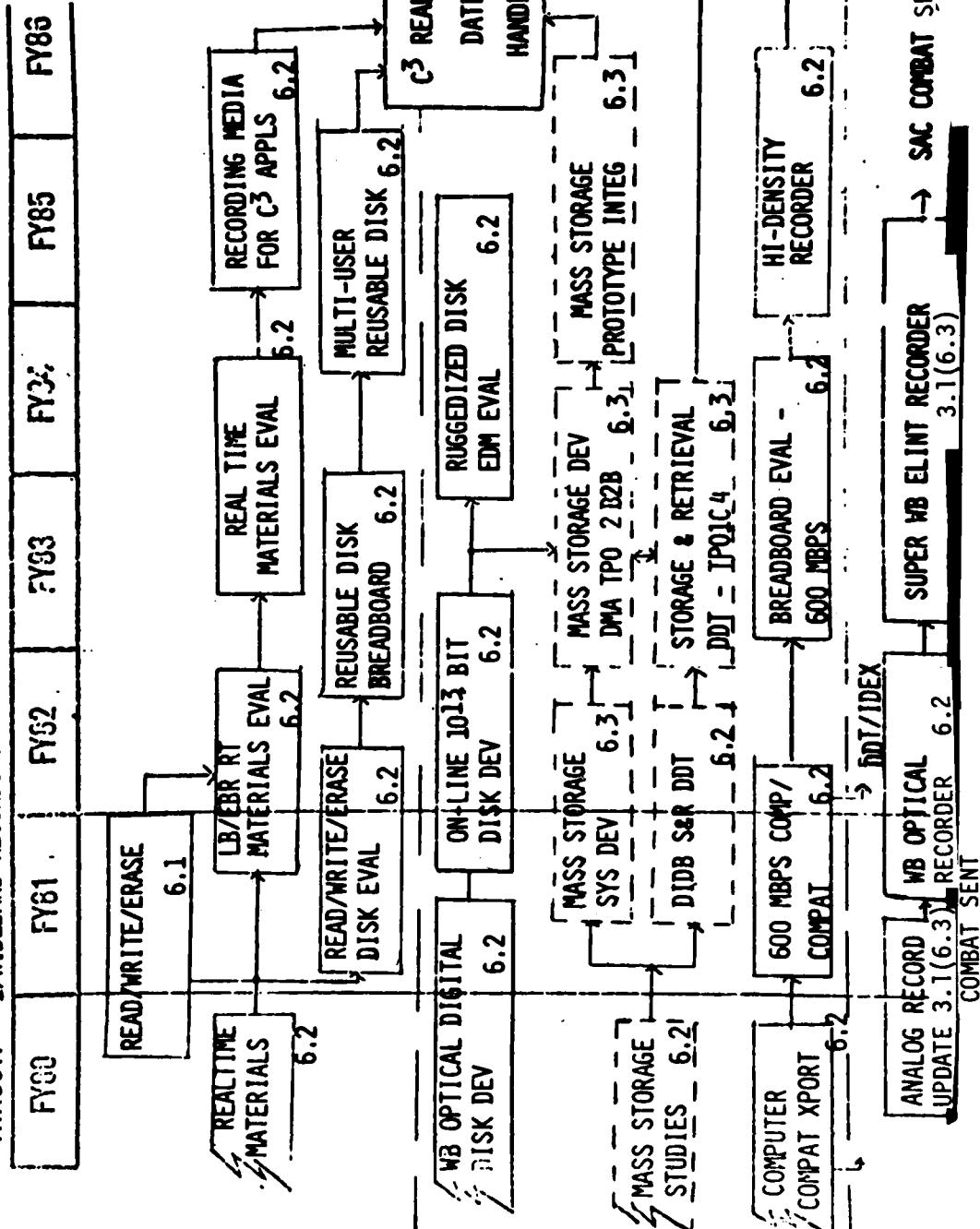
## C<sup>3</sup>1 DATA STORAGE & DISSEMINATION



EL DEMOCRATISMO Y LA INTEGRACION LATINOAMERICANA



MAJIC 193 4 TECHNOLOGY  
THRUST: 1/MIDSPAN RECORDING



IPO/THRUST: RECONNAISSANCE AND INTELLIGENCE

SUB-THRUST: WIDEBAND RECORDING

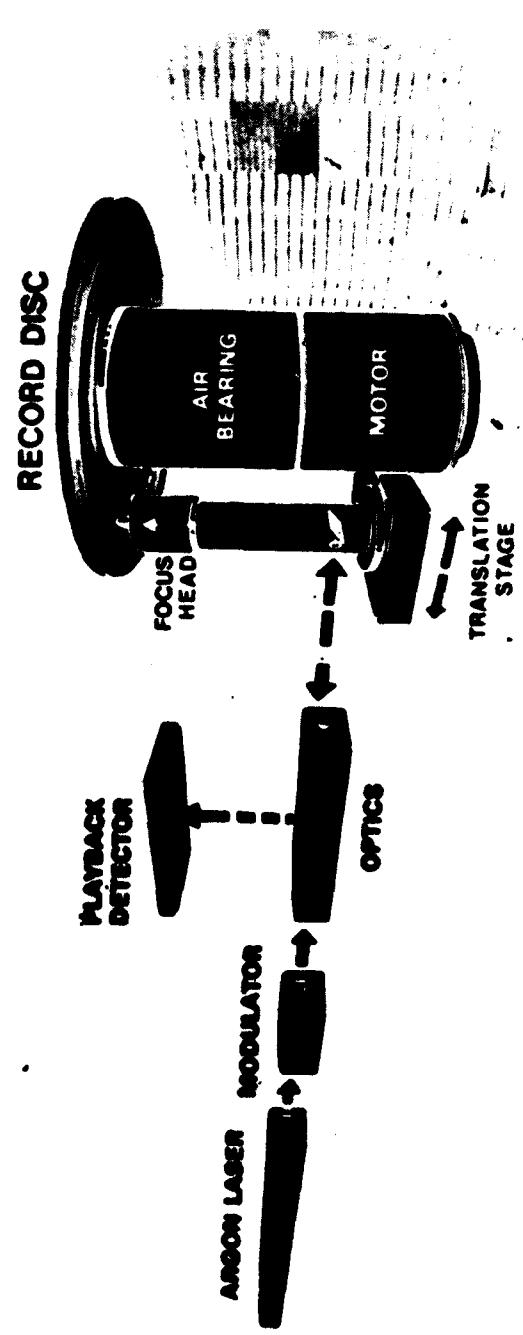
BLOCK TITLE: LB AND EBR MATERIAL EVALUATION

OBJECTIVE: PERFORM A QUANTITATIVE ANALYSIS OF REAL TIME RECORDING MATERIALS FOR APPLICATIONS SUCH AS IMAGE GENERATION (RECONNAISSANCE, TRANSMISSION AND DUPLICATION), WB OPTICAL DIGITAL DATA ACQUISITION AND HIGH DENSITY DIGITAL STORAGE AND RETRIEVAL.

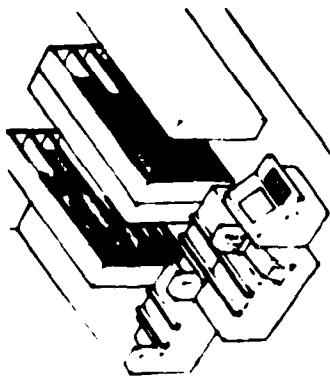
APPROACH: DETERMINE ACHIEVABLE SPEED, RESOLVING POWER, SPECTRAL RESPONSE, GRANULARITY, ETC., OF CANDIDATE MATERIALS. FABRICATE EDM, EVALUATE MATERIAL.

PAYOUT: HIGH. FLEXIBLE RECORDING MATERIALS FOR REAL TIME OR NEAR REAL TIME IMAGE AND DIGITAL DATA EXPLOITATION AND DISSEMINATION.

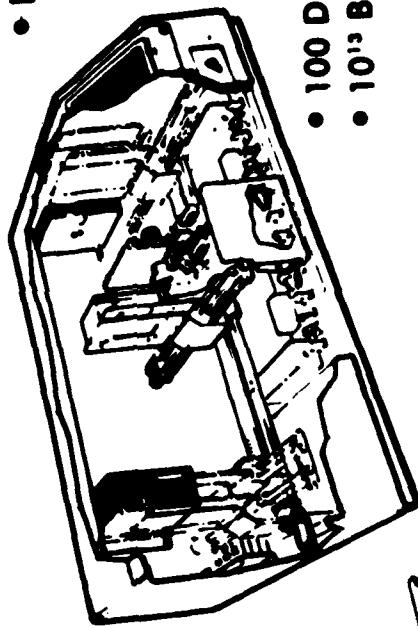
# Optical Video Disc Recorder



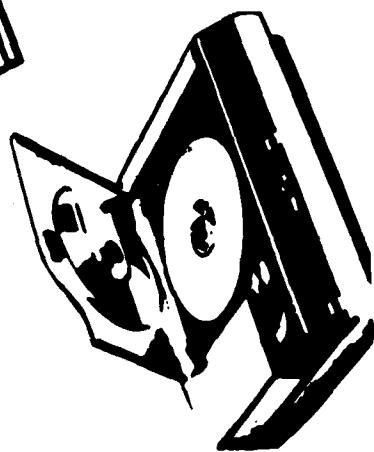
**DIGITAL STORAGE  
ON/OFF LINE  
OPTICAL DISK**



- GREATER THAN  $10^{11}$  BITS
- LONG TERM STORAGE



- 100 DISKS
- $10^{11}$  BITS STORAGE



- 12 INCH DISK
- $10^{11}$  BITS STORAGE

IPO/THRUST: RECONNAISSANCE AND INTELLIGENCE

SUB-THRUST: WIDEBAND RECORDING

BLOCK TITLE: READ/WRITE/ERASE DISK

OBJECTIVE: TO DETERMINE FEASIBILITY, LIMITATIONS AND TRADE OFFS OF APPLYING READ/WRITE/ERASE MATERIALS IN OPTICAL DIGITAL DISK CONFIGURATIONS.

APPROACH: PERFORM A QUANTITATIVE ANALYSIS OF ACHIEVABLE DATA RATE, BIT ERROR RATE, PACKING DENSITY, NUMBER OF REUSE CYCLES, ETC., AS APPLIED TO HIGH DENSITY, DIGITAL EXPLOITATION SCENARIOS.

PAY OFF: HIGH, EXTREMELY FLEXIBLE DIGITAL DISK FOR REAL TIME HIGH DATA RATE, HIGH VOLUME DIGITAL EXPLOITATION.

IPO/THRUST: RECONNAISSANCE AND INTELLIGENCE

SUB-THRUST: WIDEBAND RECORDING

BLOCK TITLE: REUSABLE DISK BREADBOARD

OBJECTIVE: TO DESIGN, DEVELOP AND EXPERIMENTALLY EVALUATE EXPLORATORY DEVELOPMENT MODEL OF A ERASABLE/REUSABLE DIGITAL OPTICAL DISK.

APPROACH: CANDIDATE MATERIALS FROM THE ERASE/REUSE INVESTIGATIONS WILL BE EVALUATED AS POTENTIALS IN OPTICAL DISK CONFIGURATIONS.

PAYOUT: HIGH. EXTREMELY FLEXIBLE DIGITAL DISK FOR REAL TIME EXPLOITATION OF HIGH RESOLUTION DIGITAL IMAGERY. HIGH DATA RATE INTELLIGENCE DATA, ETC.

SCOPE: RECONNAISSANCE AND INTELLIGENCE

SCOPE: WIDEBAND RECORDING

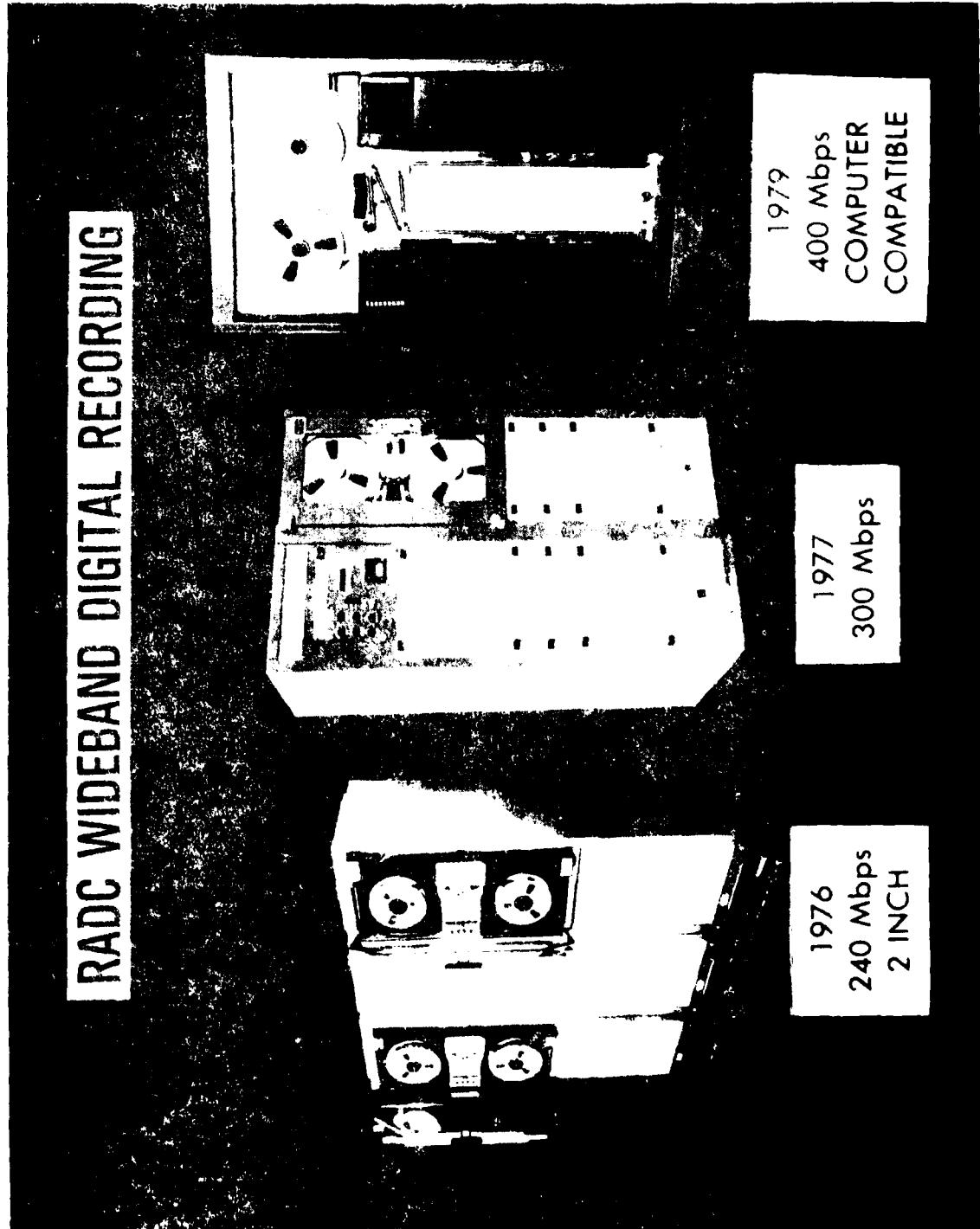
SCOPE:  $10^{13}$  ON-LINE 10 BIT DISK DEVELOPMENT

SCOPE: DESIGN, DEVELOP AND EXPERIMENTALLY EVALUATE OPTICAL DIGITAL DISK TECHNOLOGY IN A "JUKE BOX" CONFIGURATION FOR MASS STORAGE AND RETRIEVAL APPLICATIONS.

SCOPE: IMPLEMENT  $10^{13}$  "JUKE BOX" TO DETERMINE FEASIBILITY, LIMITATIONS AND ULTIMATE CAPABILITIES.

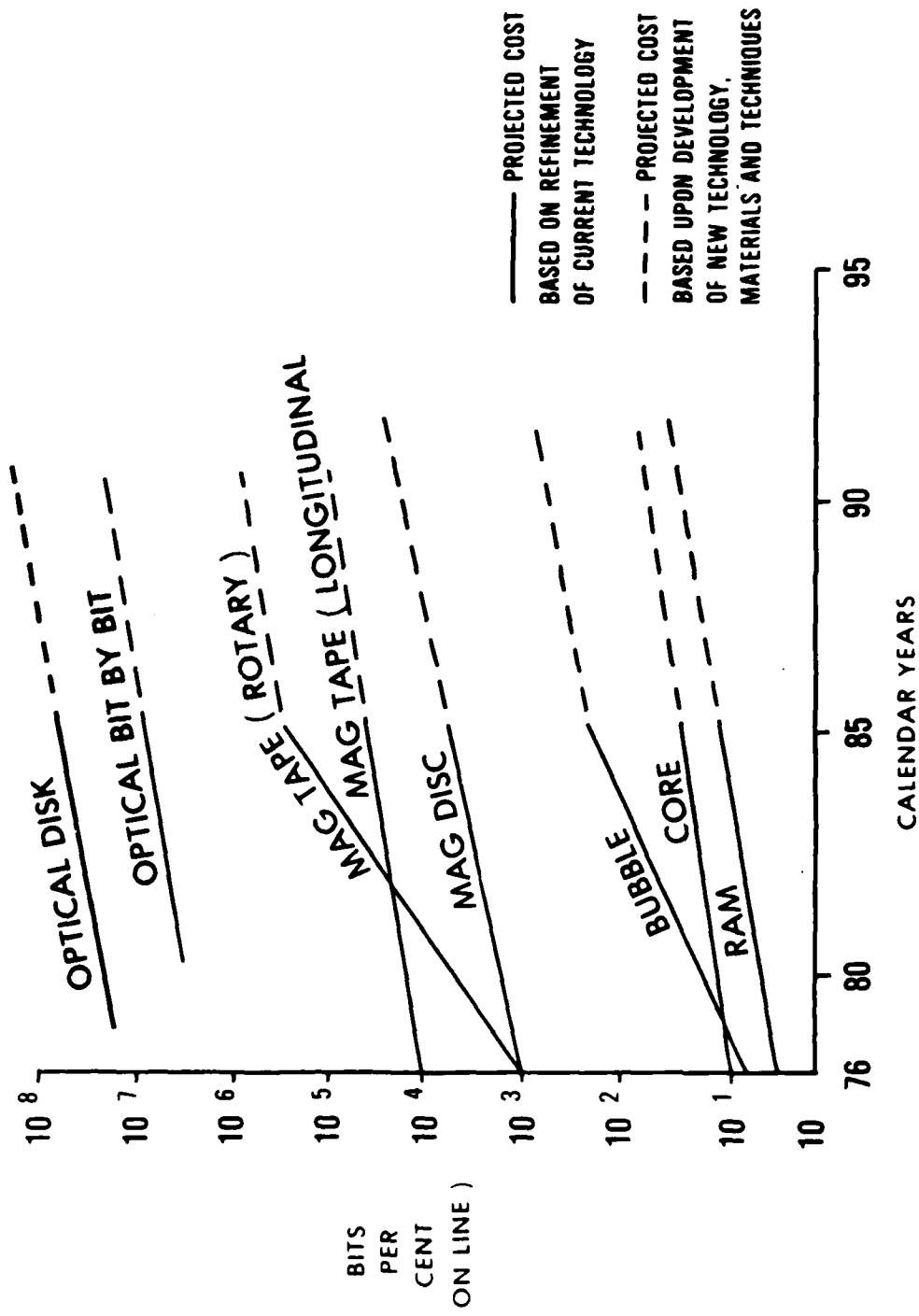
SCOPE: HIGH. EXTREMELY FLEXIBLE DATA BASE MANAGEMENT CONCEPT TO HANDLE LARGE DATA BASES, WHERE FAST ACCESS IS REQUIRED.

## RADC WIDEBAND DIGITAL RECORDING



<u>TYPE/THRUST:</u>	RECONNAISSANCE AND INTELLIGENCE
<u>SUB-THRUST:</u>	WIDEBAND RECORDING
<u>BLOCK TITLE:</u>	600 MEGABIT PER SECOND COMPUTER COMPATIBLE TAPE RECORDER
<u>OBJECTIVE:</u>	DESIGN, DEVELOP AND DEMONSTRATE AN EXPLORATORY DEVELOPMENT MODEL 600 MBPS, AND BEYOND COMPUTER COMPATIBLE TAPE DRIVE.
<u>APPROACH:</u>	IMPROVE PACKING DENSITY AND TAPE DRIVE MECHANICAL CHARACTERISTICS TO PROVIDE REQUIRED RECORD/REPRODUCE RATES, CONTROLLED SEARCH AND FAST STOP/START CHARACTERISTICS. DEVELOP AUTOMATED ACCESSING CAPABILITY TO ACCURATELY LOCATE DATA ON TAPE.
<u>PAYOUT:</u>	HIGH. OFFERS ORDER OF MAGNITUDE IMPROVEMENT OVER THE STORAGE AND ACCESSING CAPABILITIES OF CONVENTIONAL COMPUTER COMPATIBLE TAPE (CCT) UNITS.

HI DENSITY RECORDING  
PROJECTED STORAGE COSTS  
( BITS PER CENT )



KEY CONTACT POINTS

ALBERT A. JAMBERDINO  
JACK D. PETRUZZELLI  
LT. JAMES L. HANGER  
WALTER S. CZYZICKI  
WILLIAM C. ZIESENITZ

RADC/IRAP  
RADC/IRAP  
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RADC/IRAP

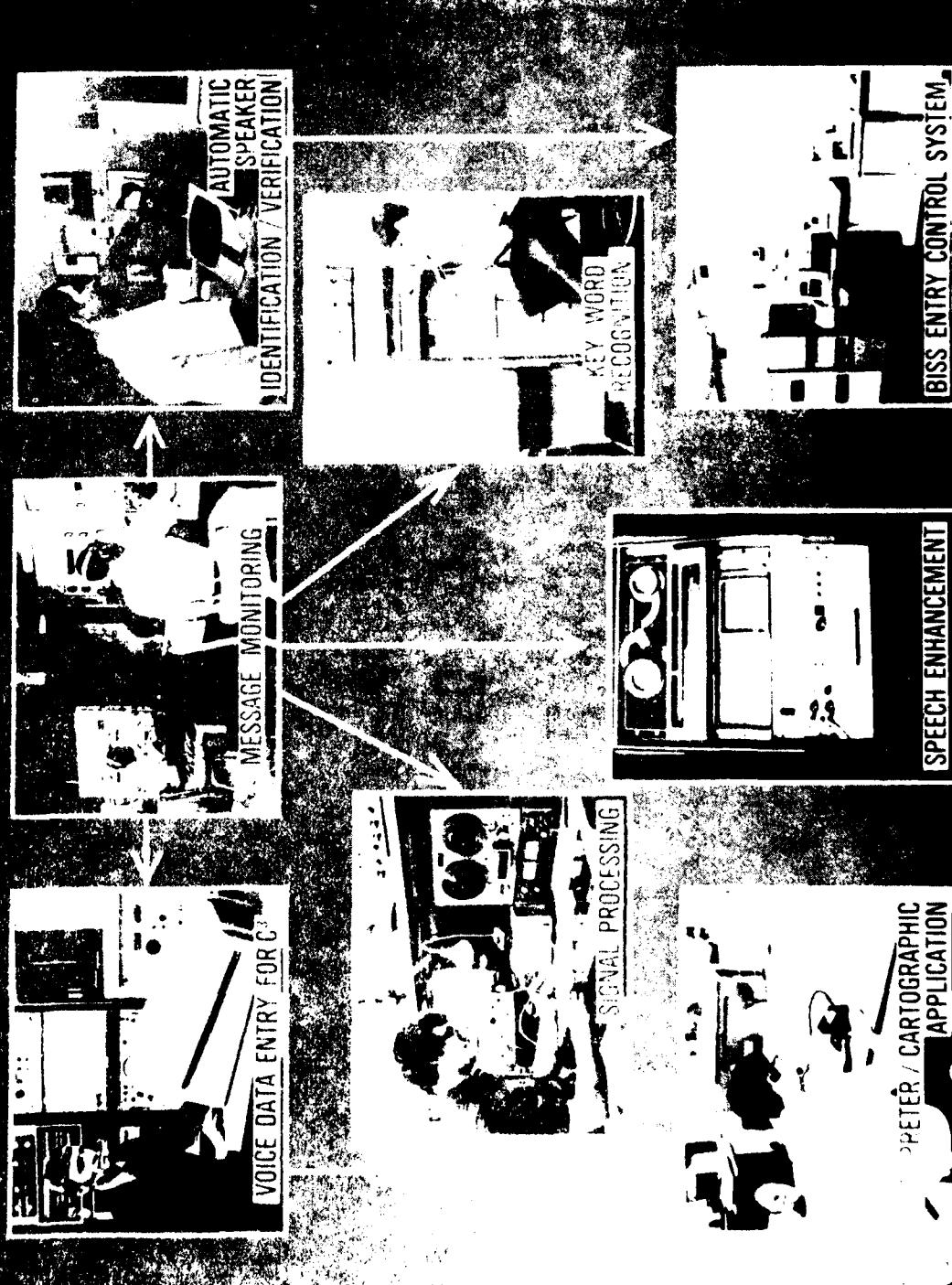
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**SPEECH PROCESSING**  
**ADVANCED/EXPLORATORY**  
**DEVELOPMENT OVERVIEW**

PRESENTED BY:  
DR. BRUNO BEEK

## RADC SPEECH / AUDIO PROCESSING TECHNOLOGY



**TOP/THRUST:** RECONNAISSANCE & INTELLIGENCE  
**SUB-THRUST:** SPEECH PROCESSING

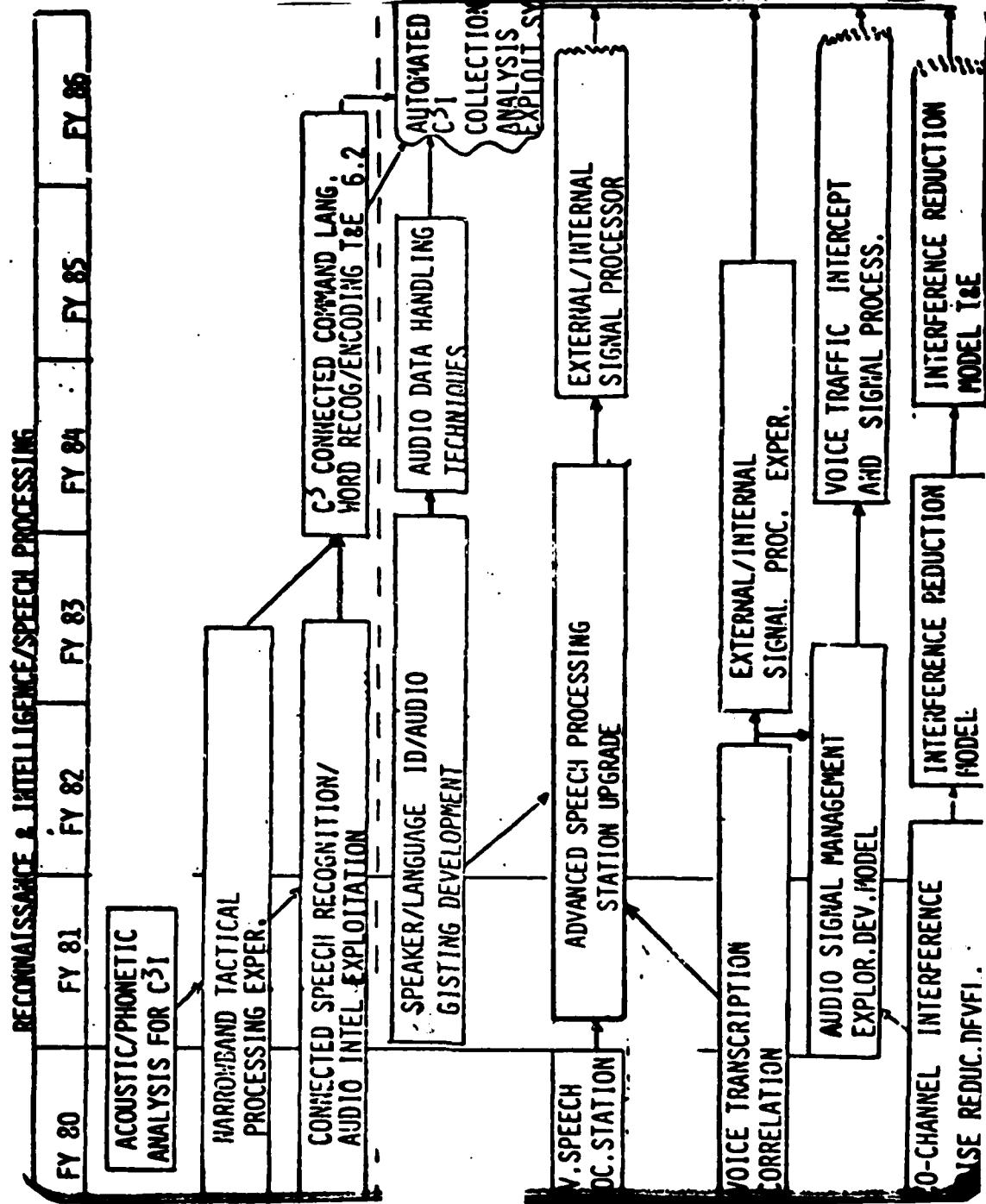
**PROGRAM GOALS:** TO DEVELOP AND IMPLEMENT AUTOMATED TECHNIQUES FOR VOICE DATA ENTRY  
NARROWBAND COMMUNICATIONS, AND EXPLOITATION OF INTERCEPT VOICE DATA.

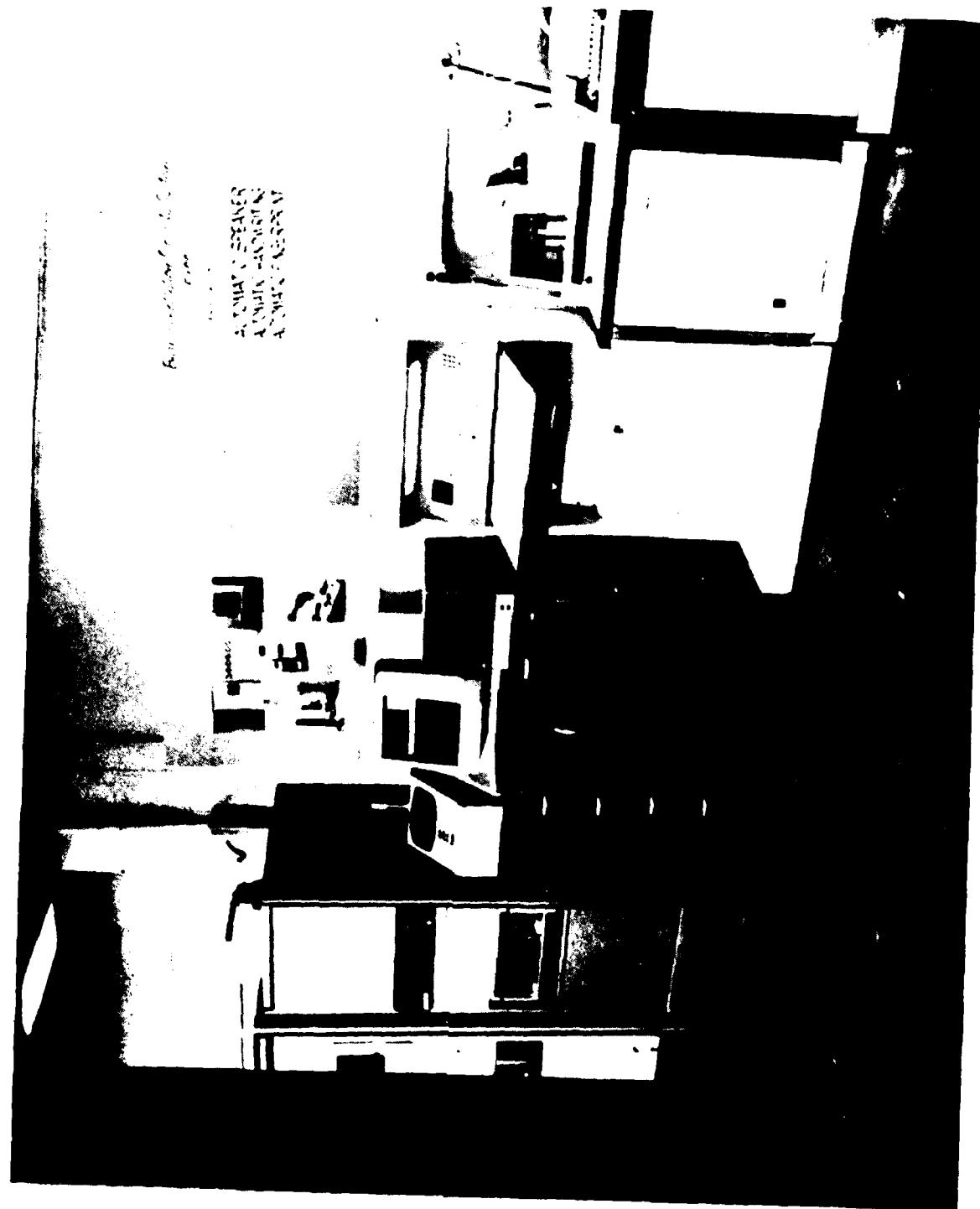
**TECHNICAL AREAS:**

AUDIO/SPEECH EXPLOITATION  
COMINT AUDIO TRANSCRIPTION  
AUDIO ENHANCEMENT  
ADVANCED SPEECH PROCESSING

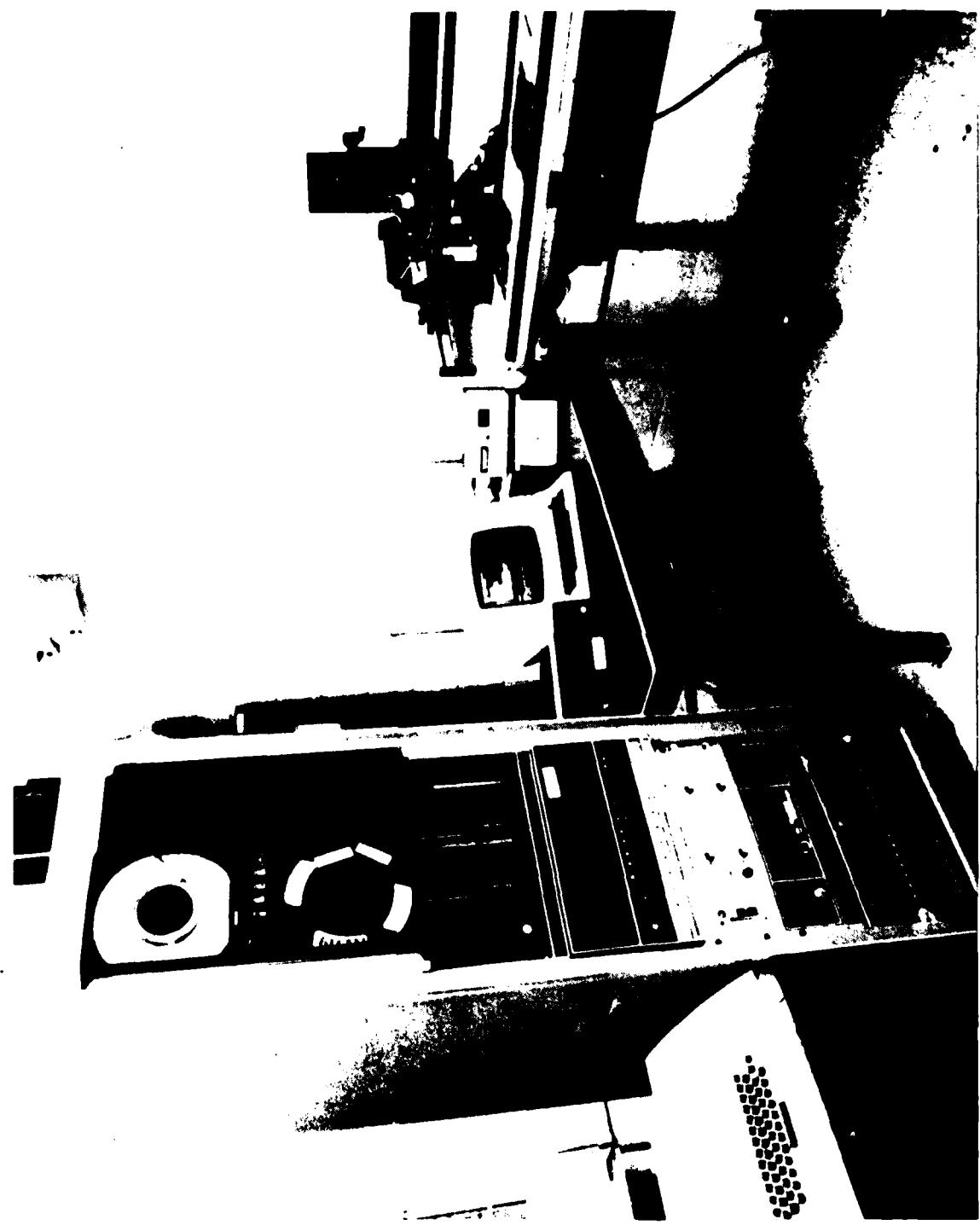
**PROGRAMS** FY 81-86 FUNDING  
(IN THOUSANDS)

6.1	450
6.2	6,000
6.3	2,000





TPO/THRUST: RECONNAISSANCE & INTELLIGENCE  
SUB-THRUST: SPEECH PROCESSING  
BLOCK TITLE: NARROWBAND TACTICAL PROCESSING EXPERIMENT  
OBJECTIVE: DEVELOP A SPEECH PROCESSING TECHNOLOGY CAPABLE OF TRANSMITTING/  
RECEIVING SPEECH SIGNALS AT DATA RATES OF LESS THAN 200 BITS/  
SECOND.  
TECHNICAL APPROACH: INVESTIGATE AUTOMATIC PHONETIC ANALYSIS/SYNTHESIS TECHNIQUES  
WHICH CAN PROVIDE INTELLIGIBLE, NATURAL, AND HIGH QUALITY  
SPEECH.  
PAYOUT: REDUCE BIT RATE IN TACTICAL COMMUNICATION LINKS AND IMPROVED  
RESISTANCE TO JAMMING.



TPO/THRUST: RE CONNAISSANCE & INTELLIGENCE  
SUB-THRUST: SPEECH PROCESSING

BLOCK TITLE: CONNECTED SPEECH RECOGNITION & AUDIO INTEL EXPLOITATION

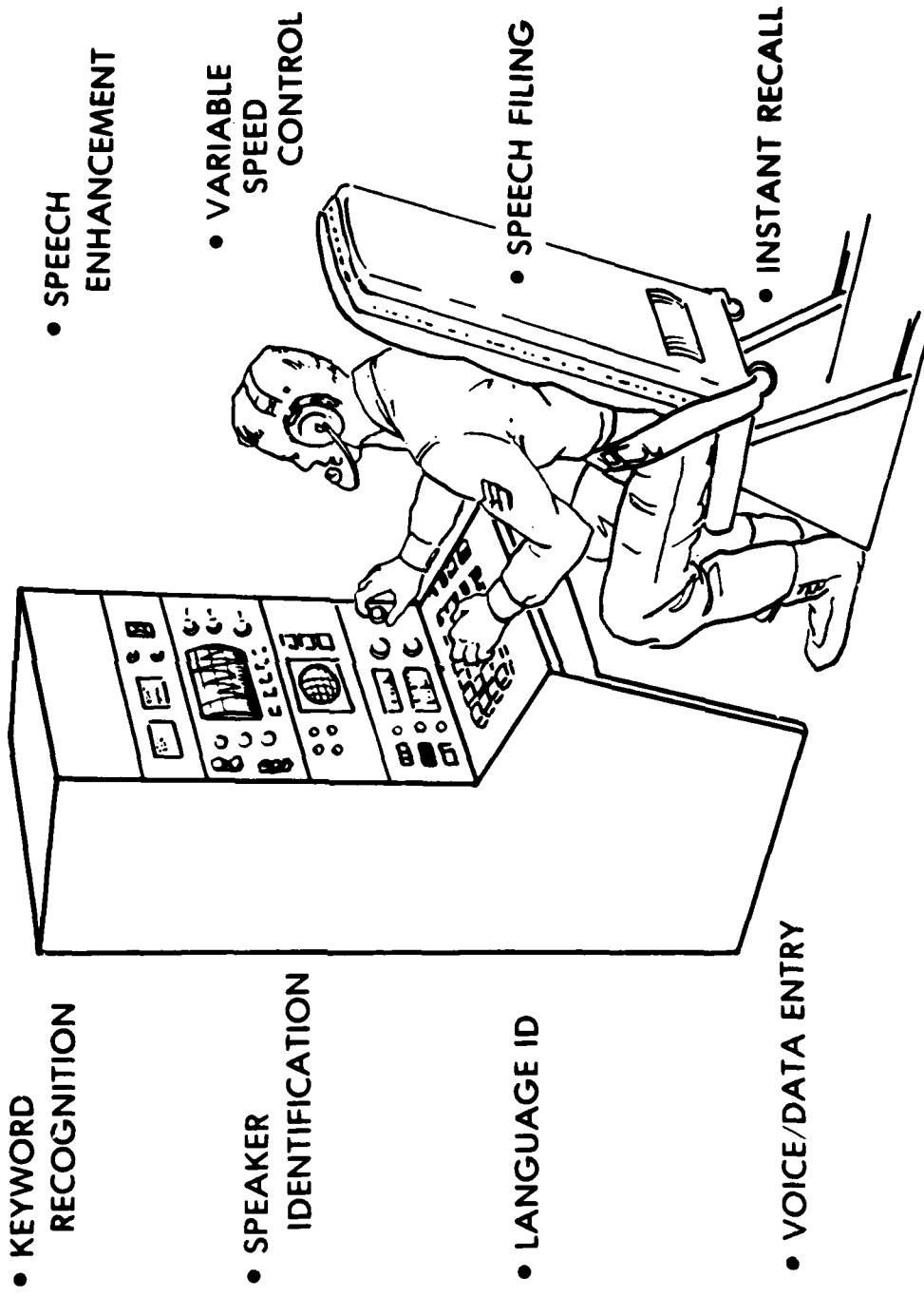
OBJECTIVES: DEVELOP A HIGHLY RELIABLE CONNECTED WORD RECOGNITION TECHNIQUE  
FOR C<sup>3</sup>1 APPLICATIONS.

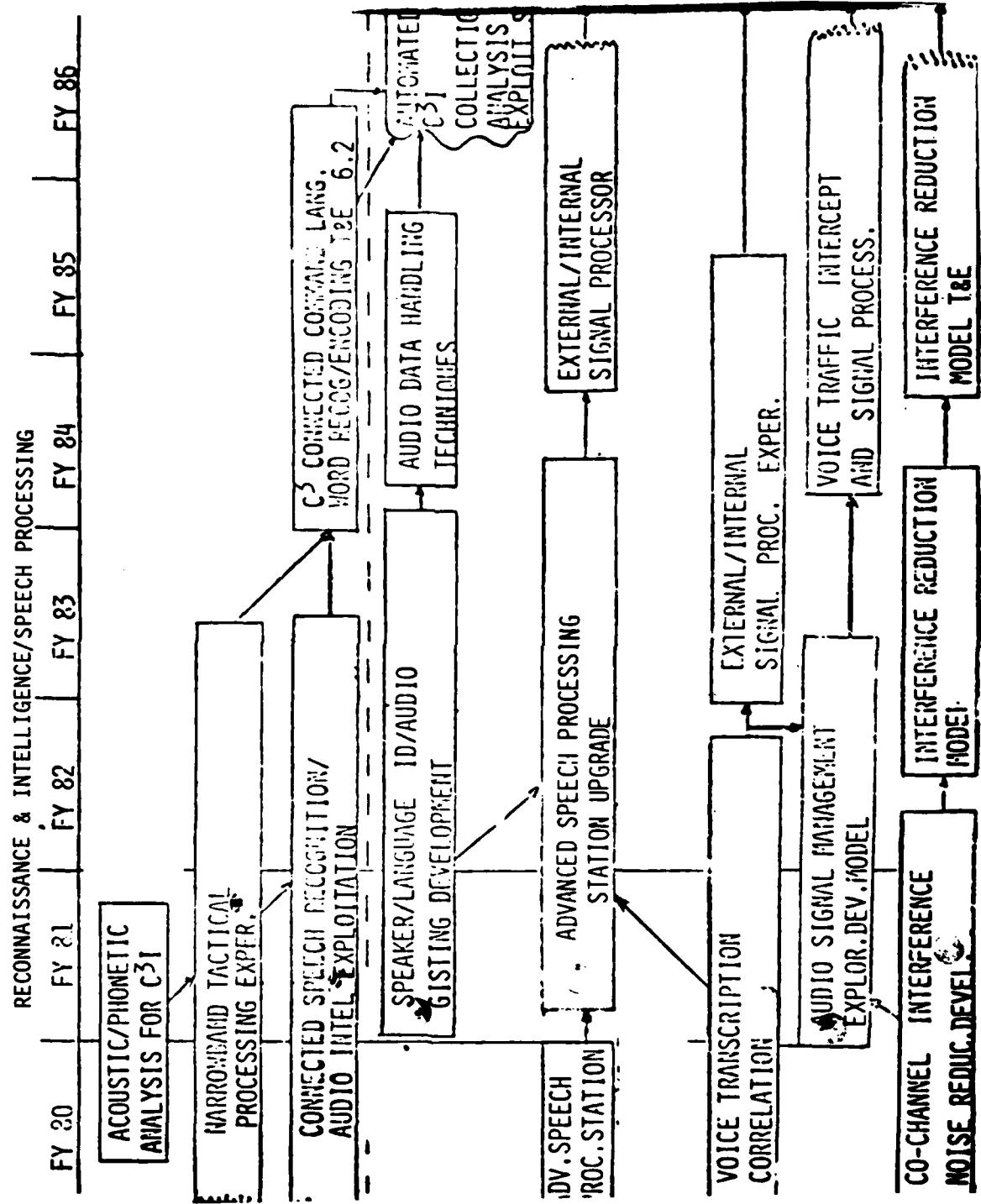
ANALYSIS OF ACOUSTIC INTEL SIGNALS.

TECHNICAL APPROACH: FABRICATE, TEST, AND EVALUATE A BREADBOARD MODEL OF A SOLID STATE  
LIMITED CONNECTED WORD RECOGNITION SYSTEM.  
DEVELOPMENT OF AUTOMATED ACOUSTIC SIGNAL PROCESSING TECHNIQUES.

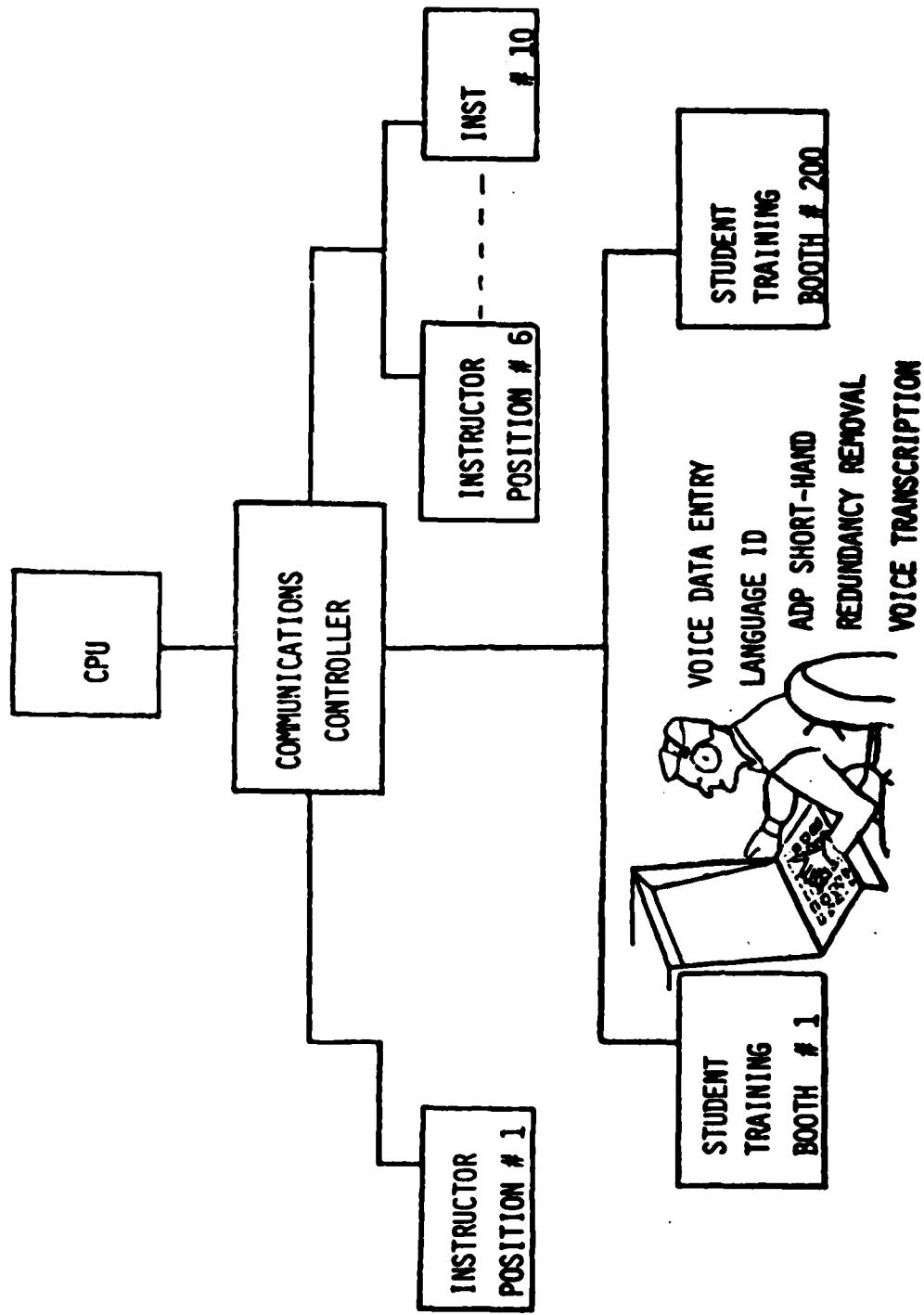
PAYOUT: NATURAL CONNECTED WORD RECOGNITION FOR AIR FORCE C<sup>3</sup>1 PROGRAMS.  
AUTOMATED BACKGROUND NOISE ANALYSIS FOR FTD.

## ADVANCED SPEECH PROCESSING STATION (ASPS)



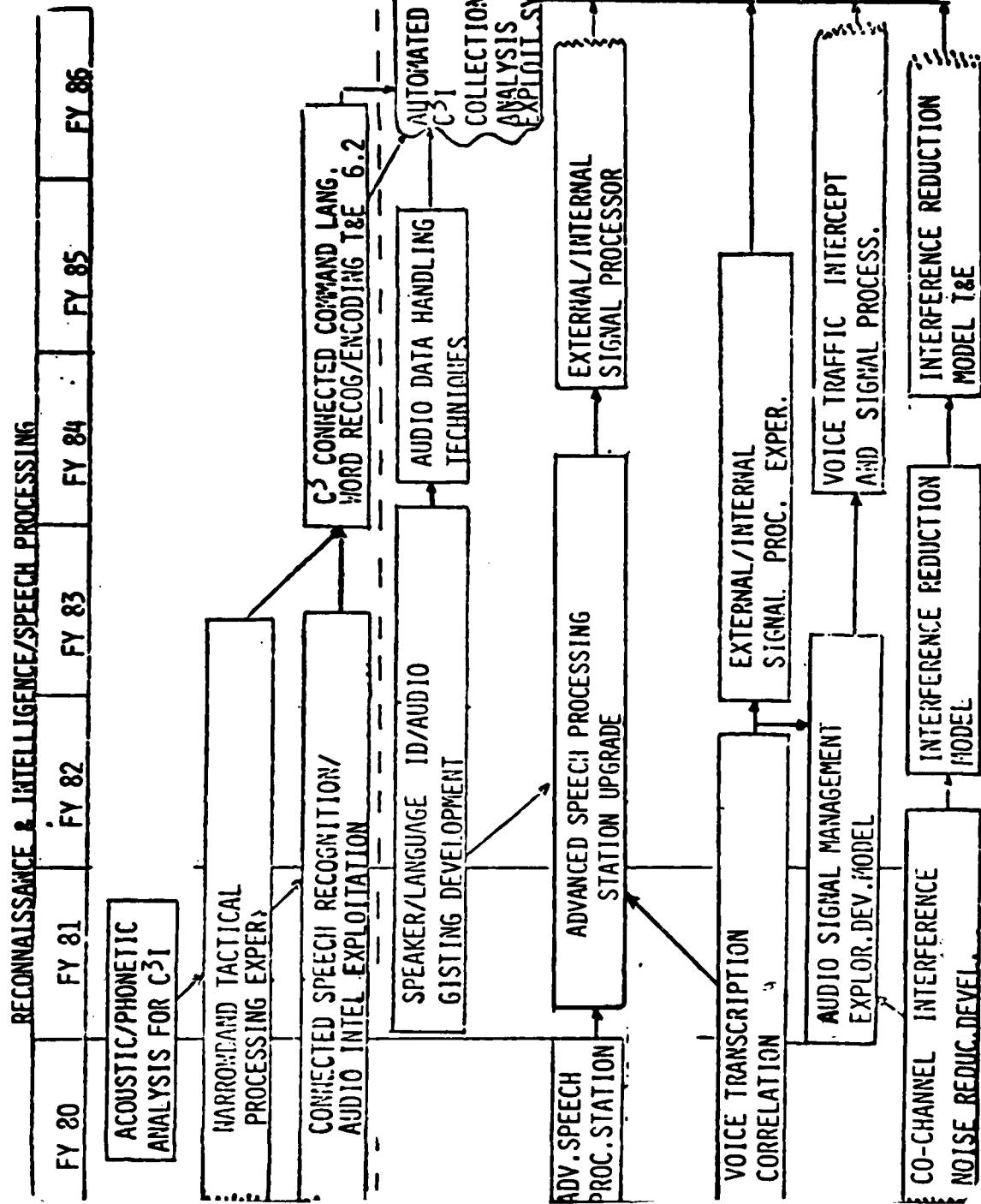


VOICE PROCESSOR TRAINING SYSTEM (VPTS)  
(COMPUTER AIDED INSTRUCTIONS)



RADC SPEECH PROCESSING PROGRAM

TECH AREAS		MESSAGE SORTING	COMMUNICATIONS ENHANCEMENT
DEVELOPMENT STAGE	VOICE DATA ENTRY	ENTRY CONTROL	
BASIC RESEARCH	IN-HOUSE DATA ENTRY TEST BED		PHONEMIC LOW DATA RATE COMMUNICATIONS
EXPLORATORY DEVELOPMENT	SOLID STATE, CONNECTED SPEECH, MULTI-MODE DATA ENTRY	DEVELOPMENT OF NEW PERSONAL ATTRIBUTES HYBRID SYSTEMS	IN-HOUSE LOW DATA RATE COMM., MULTI-TALKER SEPARATION, NOISE FILTER
ADVANCED DEVELOPMENT	DLMS ADVANCED DEVELOPMENT MODEL	OPERATIONAL TESTING OF ADVANCED PIA DEVICES	SPEECH ENHANCEMENT OPERATIONAL T & E
ENGINEERING DEVELOPMENT	MULTI-STATION DLMS VOICE DATA ENTRY		ENGINEERING DEVELOPMENT OF ASV



<u>KEY CONTACT POINTS</u>	
DR. BRUNO BEEK	-
MR. RICHARD S. YONUSA	-
MR. EDWARD J. CUPPLES	-
MR. MELVIN G. MANOR	-
LT JOHN V. FERRANTE	-
LT JEFFREY P. WOODARD	-

RADC EQUIPMENT/SYSTEM R&M PROGRAM

CONTACTS

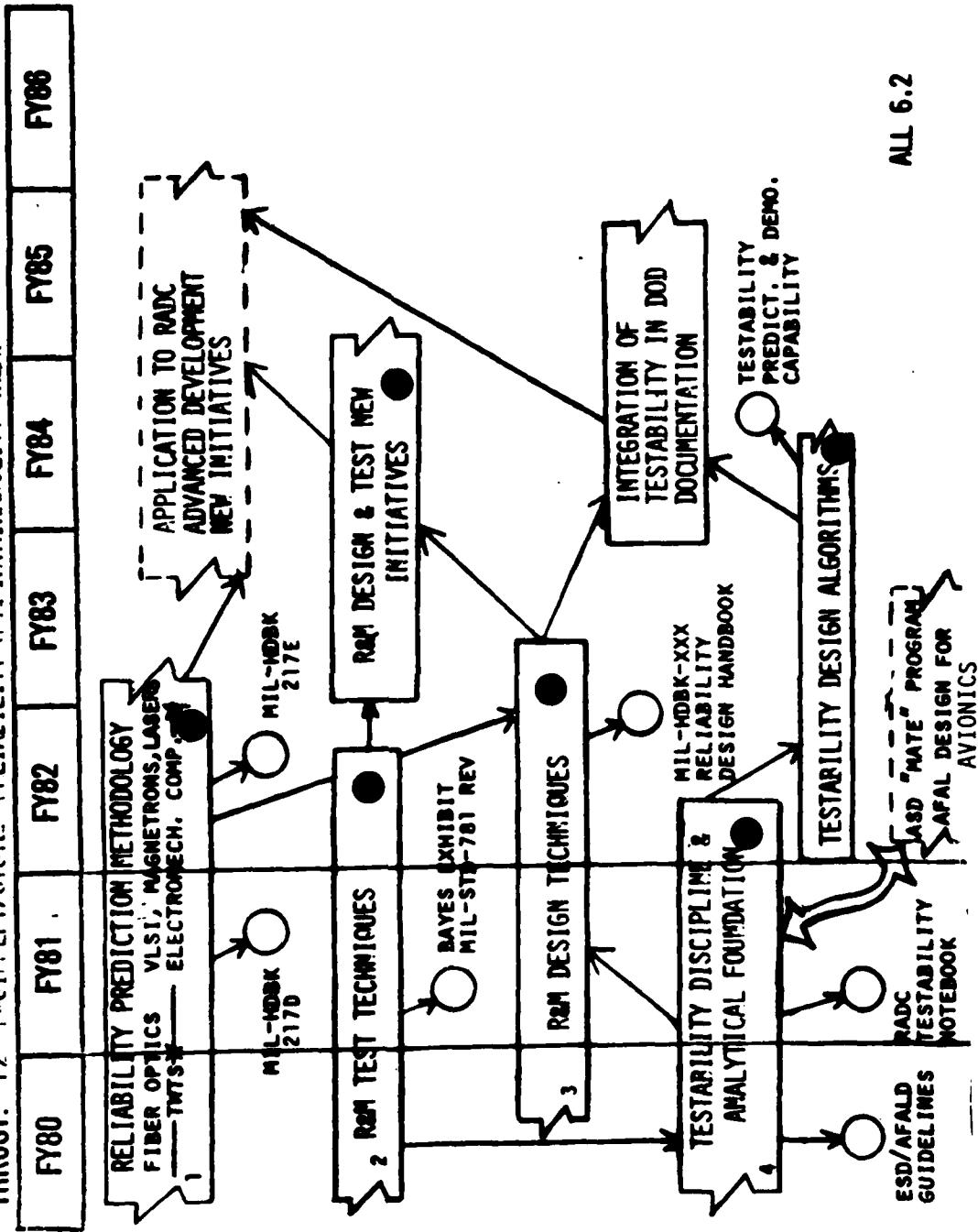
ENGINEERING BRANCH (RBE) - ANTHONY J. FEDUCCIA - X4920

R&M ENGINEERING TECHNIQUES SECTION (RBET) - ANTHONY COPPOLA - X4726

R&M ENGINEERING SECTION (RBER) - ANTHONY D. PETTINATO - X2702

SYSTEM ENGINEERING SECTION (RBES) - RICHARD MAIR - X3068

RAUDU TPD IV TECHNOLOGY F2 EQUIPMENT/SYSTEM RELIABILITY & MAINTAINABILITY (REM)



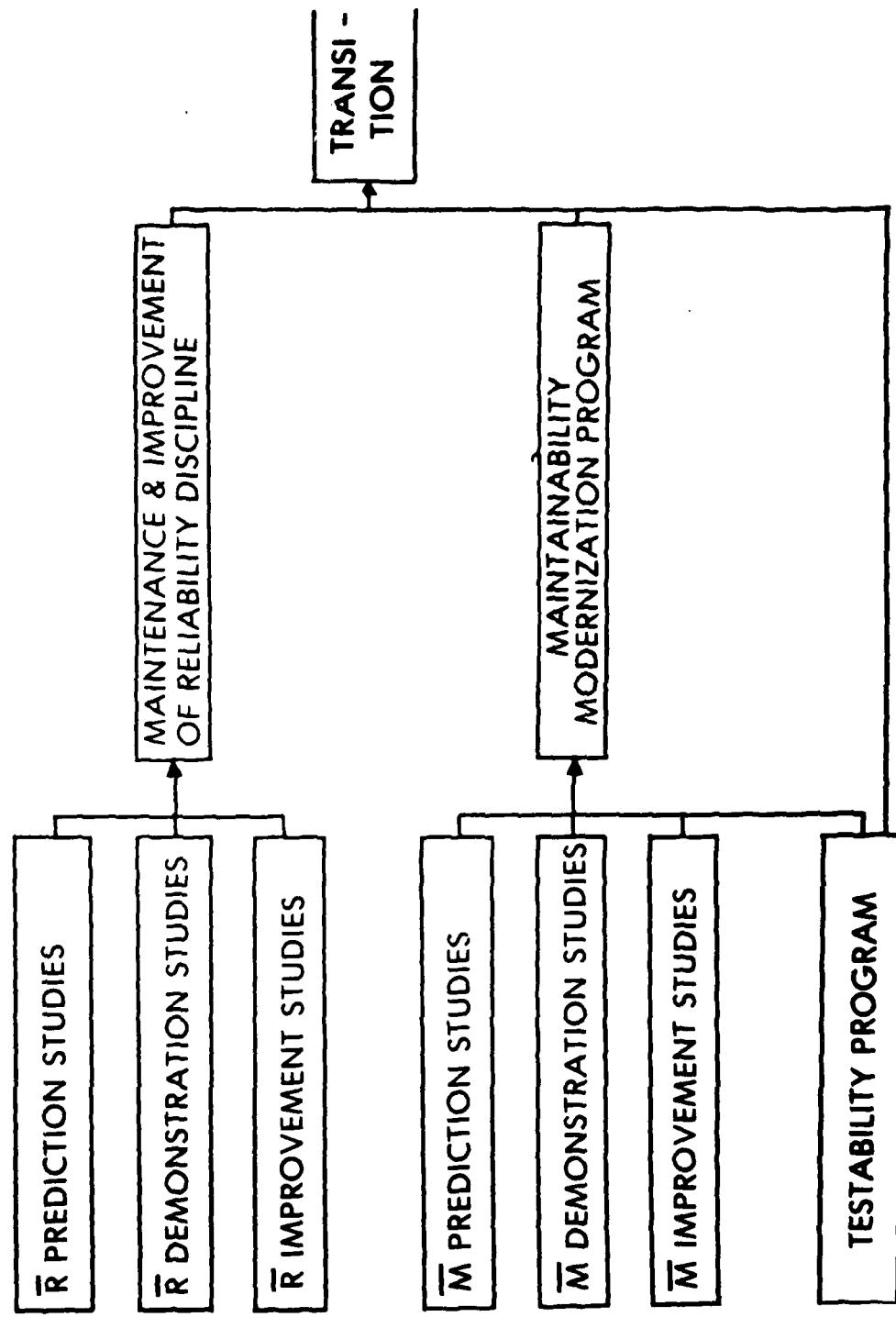
ALL 6.2

**RADC EQUIPMENT/SYSTEM R&M PROGRAM**  
**PRESENTATION OUTLINE**

- OVERVIEW
- RELIABILITY TECHNIQUES
- MAINTAINABILITY TECHNIQUES
- RELIABILITY ANALYSIS CENTER
- MILITARY STANDARDS AND HANDBOOKS
- R&M ENGINEERING SUPPORT
- SUMMARY

# RADC EQUIPMENT/SYSTEM R&M PROGRAM

## OVERVIEW



# RADC EQUIPMENT/SYSTEM R&M PROGRAM

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## RELIABILITY TECHNIQUES

### RELIABILITY PREDICTION

RELIABILITY= THE PROBABILITY THAT AN ITEM WILL PERFORM ITS INTENDED FUNCTION FOR A SPECIFIED TIME UNDER STATED CONDITIONS.

$$R = e^{-(\sum_i \lambda_i) T}$$

MTBF=MEAN TIME BETWEEN FAILURES

$$MTBF = \frac{1}{\sum_i \lambda_i}$$

$\lambda_i$  = FAILURE RATE OF AN INDIVIDUAL PART

PART FAILURE RATES CONTAINED IN MIL-HDBK-217  
"RELIABILITY PREDICTION OF ELECTRONIC EQUIPMENT".

**RELIABILITY TECHNIQUES**  
**RELIABILITY PREDICTION**

**EXAMPLE OF FAILURE RATE MODEL FOR FIELD EFFECT TRANSISTORS**

$$\lambda_p = \lambda_b (\pi_e \times \pi_a \times \pi_q \times \pi_c) \text{ FAILURES}/10^6 \text{ HOURS}$$

WHERE:

$\lambda_b$  = BASE FAILURE RATE

$\pi_e$  = ENVIRONMENTAL FACTOR

$\pi_a$  = APPLICATION FACTOR

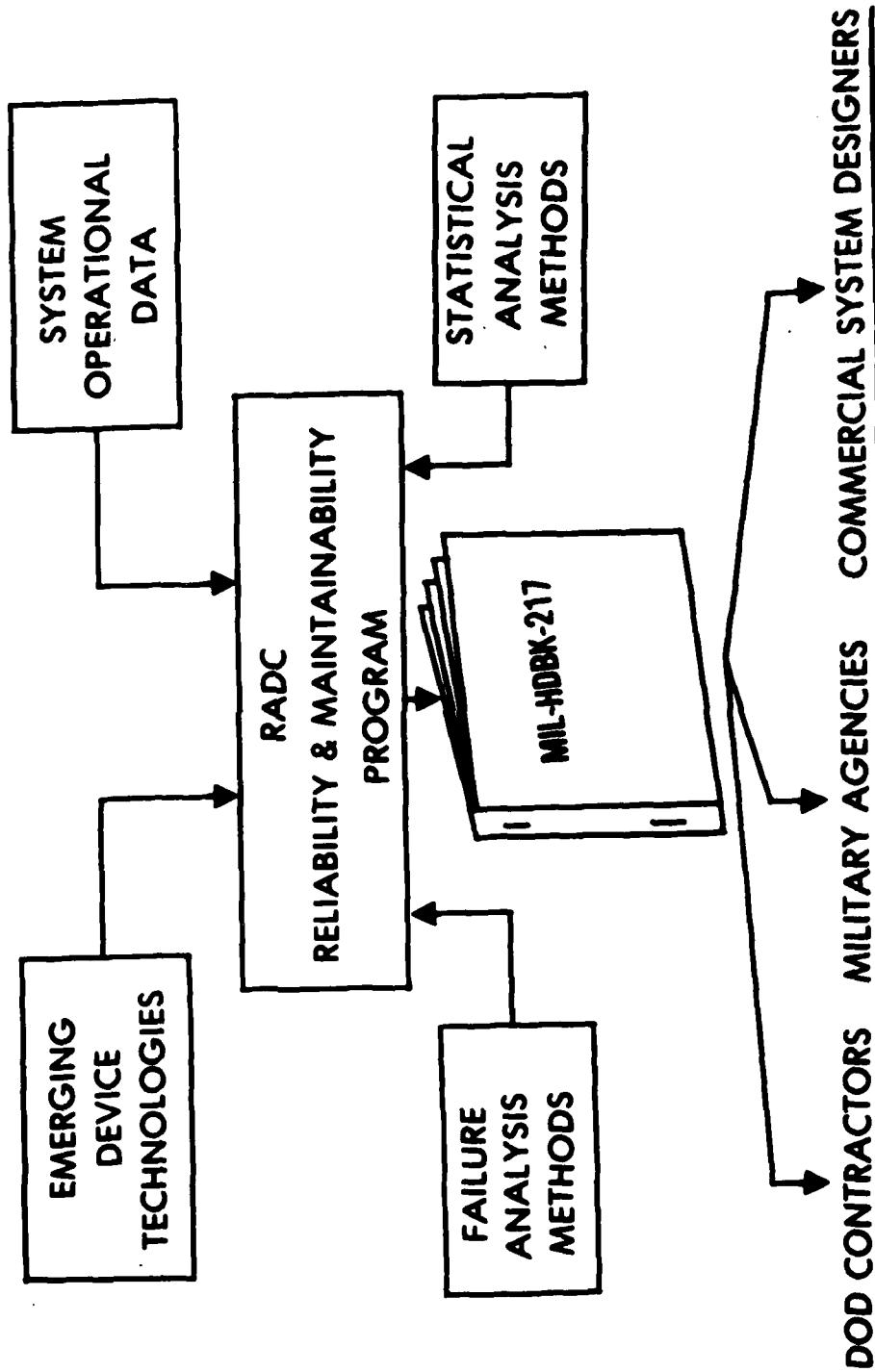
$\pi_q$  = QUALITY FACTOR

$\pi_c$  = COMPLEXITY FACTOR

SOURCE: MIL-HDBK-217B "RELIABILITY PREDICTION OF ELECTRONIC EQUIPMENT"

## **RELIABILITY TECHNIQUES**

### **RELIABILITY PREDICTION**



## **RELIABILITY TECHNIQUES**

### **RELIABILITY PREDICTION**

**MIL-HDBK-217C, NOTICE 1 AVAILABLE MAY 1980**

- MONOLITHIC IC's (SSI/MSI/LSI)
- MICROWAVE SOLID STATE DEVICES

**MIL-STD-217D SCHEDULED MARCH 1981**

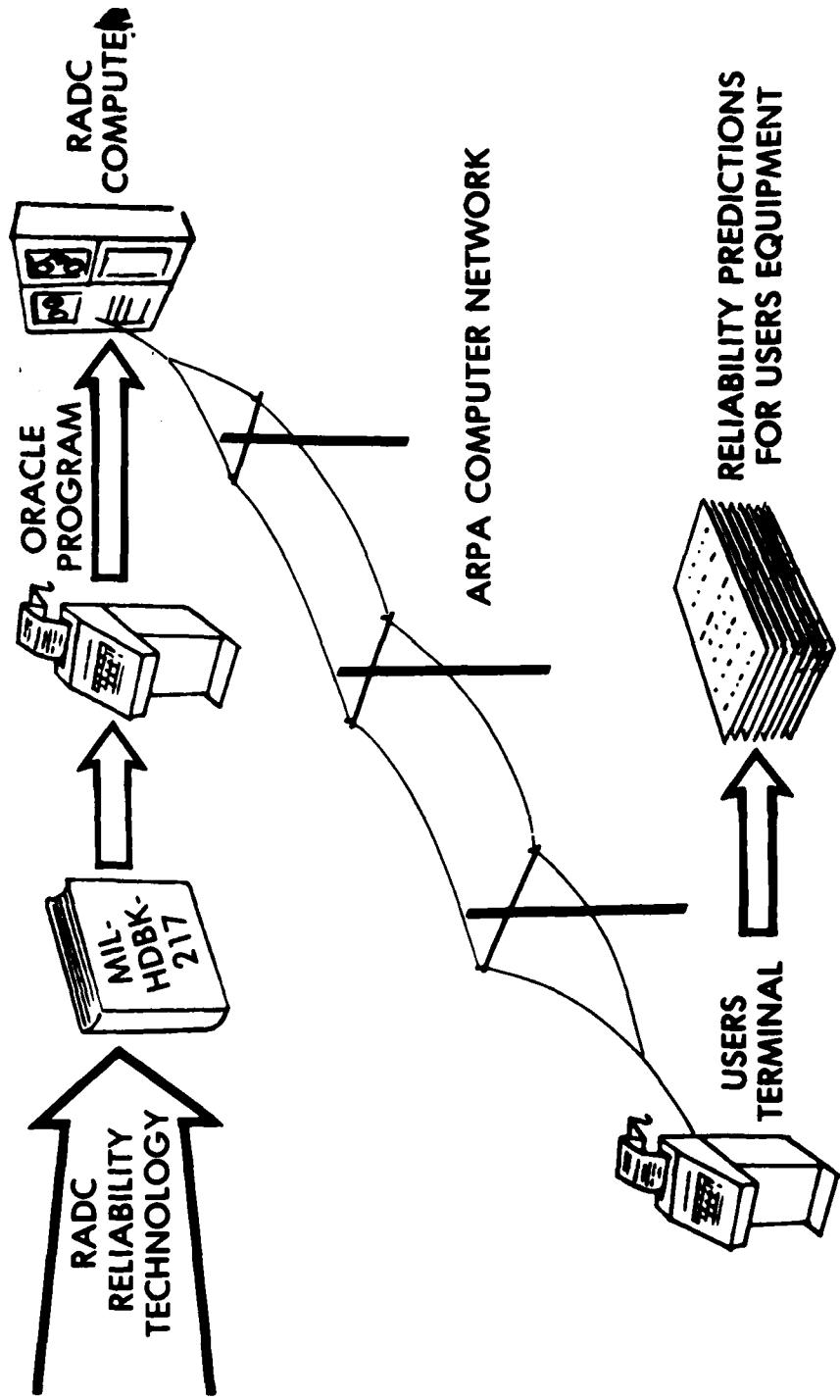
- CCD & BUBBLE MEMORIES
- GAAS FET
- ENVIRONMENTAL FACTORS (EXCEPT AVIONICS)

**MIL-HDBK-217D REVISION SCHEDULED MARCH 1982**

- MONOLITHIC IC's
- FIBRE OPTICS
- MICROWAVE POWER DEVICES
- TWT's
- AVIONIC ENVIRONMENTAL FACTORS
- FUTURE
  - LASERS
  - PC BOARDS
  - IC SOCKETS
  - VHSC

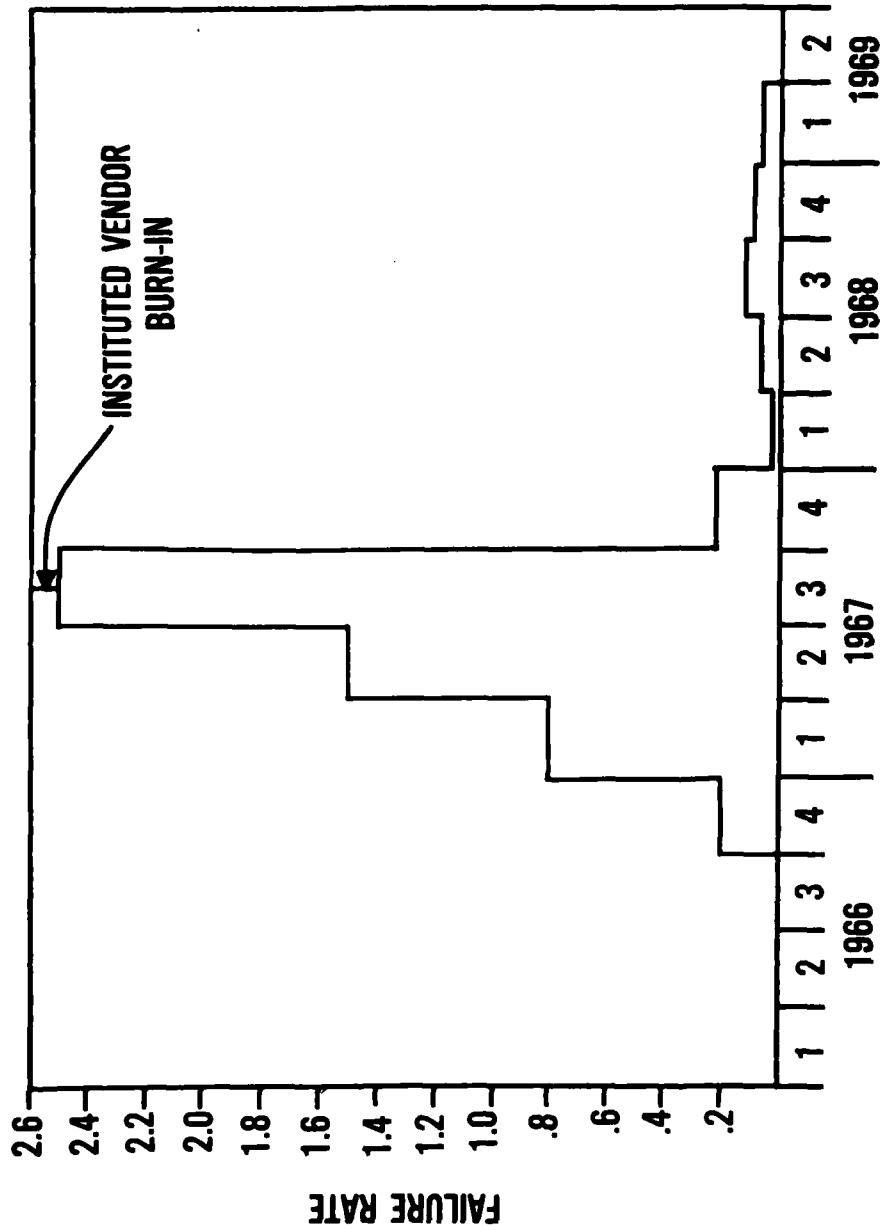
## RELIABILITY TECHNIQUES

### RADC-ORACLE RELIABILITY PREDICTION PROGRAM



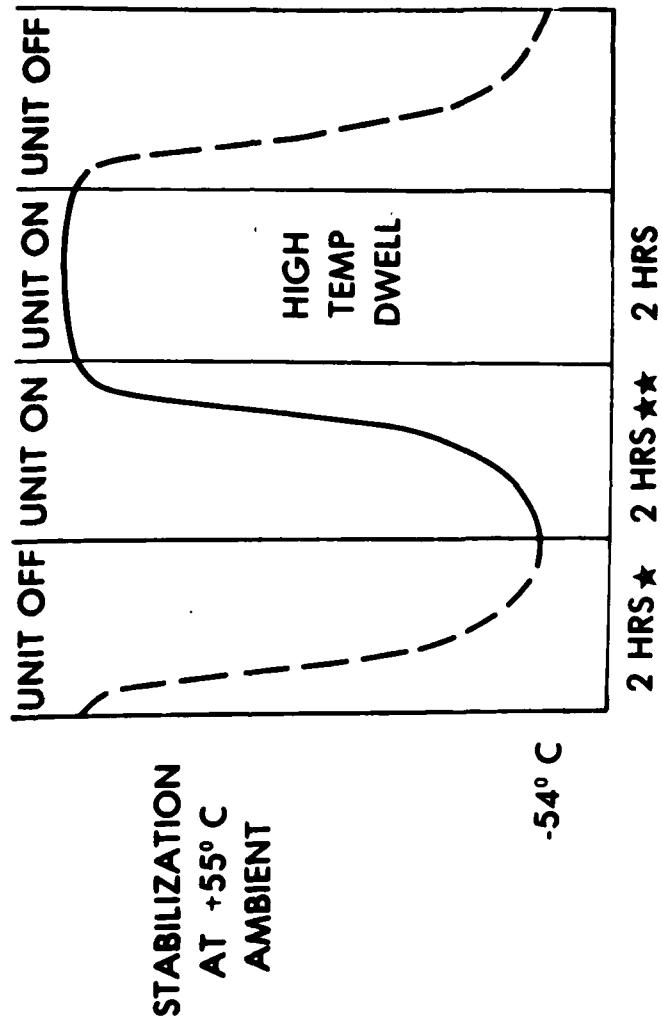
**RELIABILITY TECHNIQUES**  
**EQUIPMENT BURN-IN**

**HVPs FAILURE RATE IN F-111 RADAR TESTS**



## RELIABILITY TECHNIQUES

EQUIPMENT BURN-IN  
AN/ARC-164 BURN-IN CYCLE



2 HRS ★ 2 HRS ★ 2 HRS

- ★ TIME TO STABILIZE AT  $-54^{\circ}\text{ C}$  WITH UNIT OFF
- ★★ TIME TO STABILIZE AT  $+55^{\circ}\text{ C}$  WITH UNIT ON

## RELIABILITY TECHNIQUES

EQUIPMENT BURN-IN  
AN/ARC-164 BURN-IN

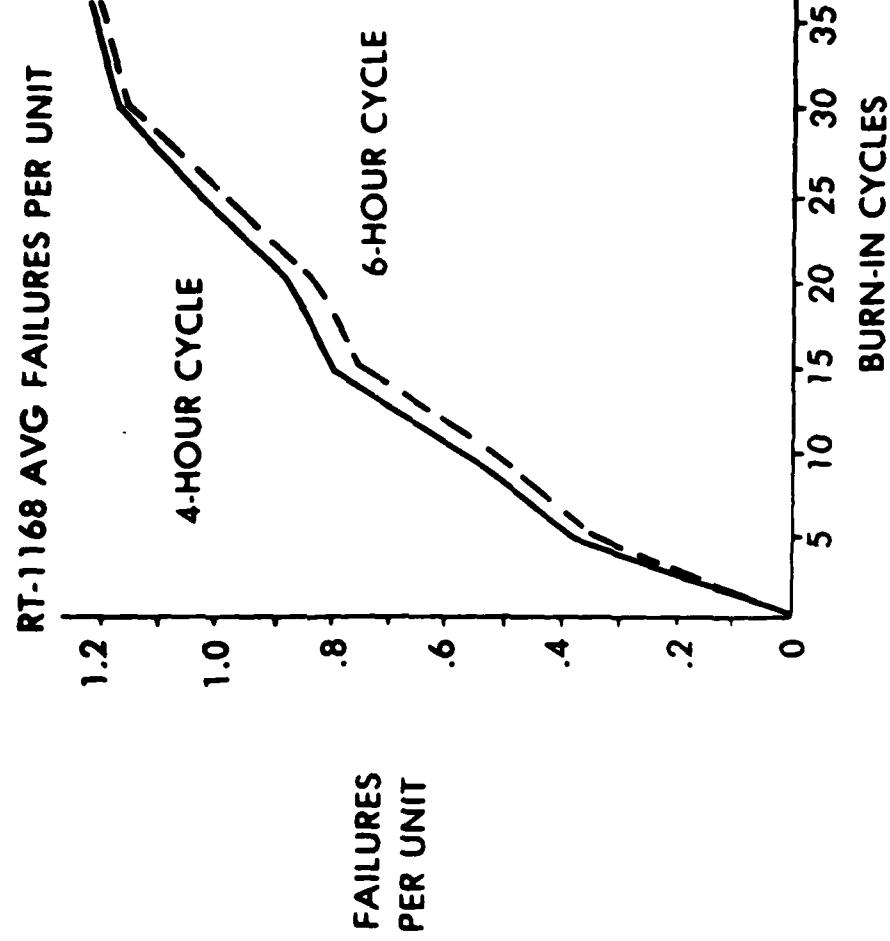
### HYPOTHESIS:

AN/ARC-164 DEFECTS ARE MORE SENSITIVE TO  
THERMAL CYCLES THAN TO SUSTAINED HIGH  
TEMPERATURE.

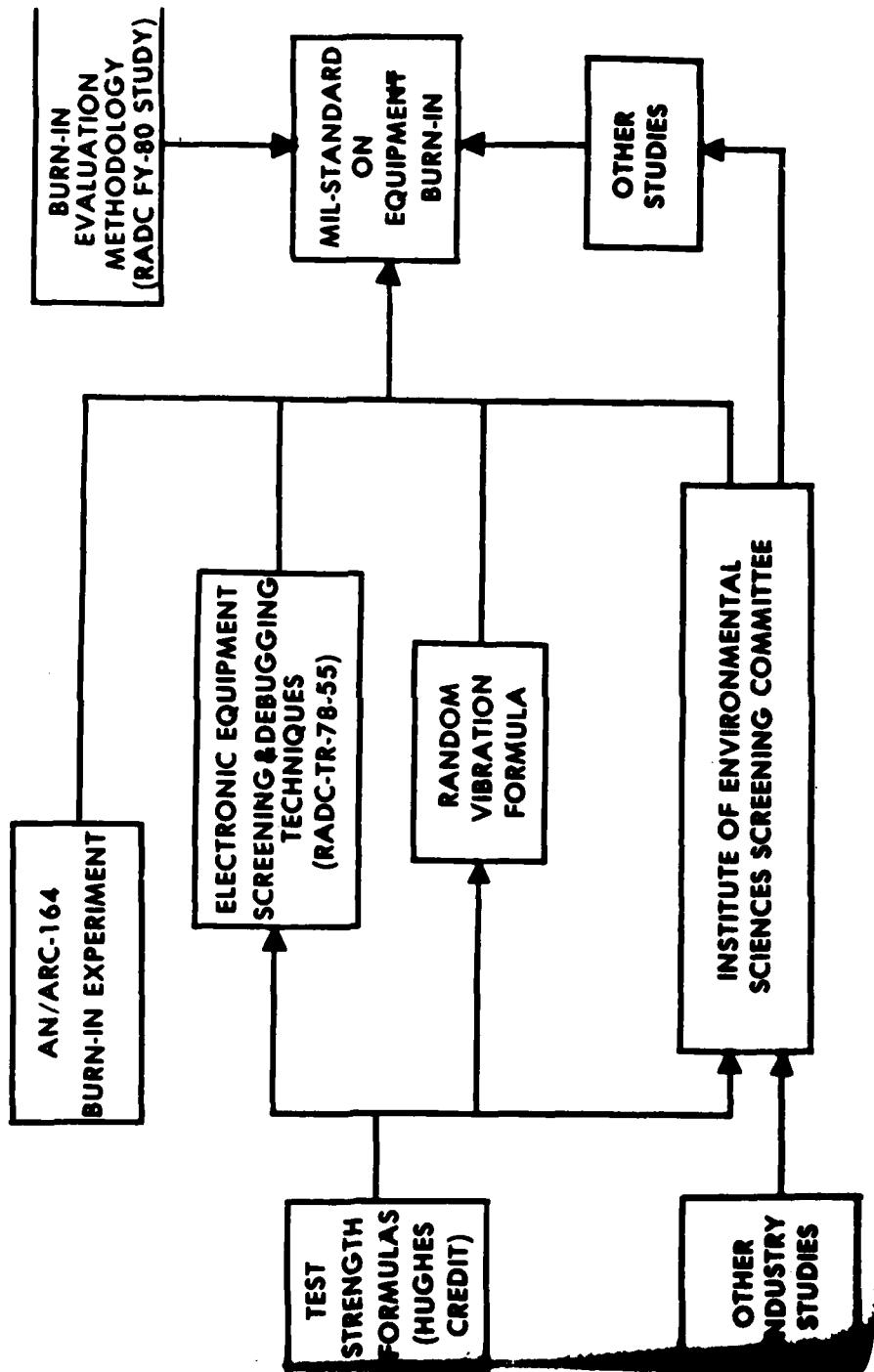
### EXPERIMENT:

HALF OF THREE MONTHS PRODUCTION BURNED.  
IN WITHOUT 2 HOUR HIGH TEMPERATURE DWELL.  
FAILURE HISTORY COMPARED TO OTHER HALF.

**RELIABILITY TECHNIQUES**  
**EQUIPMENT BURN-IN**  
**AN/ARC-164 BURN-IN**



## RELIABILITY TECHNIQUES EQUIPMENT BURN-IN



## RELIABILITY TECHNIQUES

### OTHER STUDIES OF INTEREST

#### COMPLETED

WARRANTY-GUARANTEE APPLICATION GUIDELINES FOR  
AIR FORCE GROUND ELECTRONIC EQUIPMENT (RADC-TR-79-287)

#### IN PROGRESS

COMBINED HARDWARE-SOFTWARE RELIABILITY MODELS

#### SCHEDULED FOR FY-81

- PART DERATING GUIDELINES
- SNEAK CIRCUIT ANALYSIS
- RELIABILITY OF COMMERCIAL EQUIPMENT
- RELIABILITY DESIGN HANDBOOK
- FAULT TOLERANCE IN DISTRIBUTED SYSTEMS
- NON-ELECTRONICS COMPONENT RELIABILITY

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## MAINTAINABILITY TECHNIQUES

### MAINTAINABILITY PROBLEMS

#### PREDICTION METHODS ARE OBSOLETE:

- BASED ON REGRESSION ANALYSIS OF EQUIPMENTS BUILT 15 YEARS AGO

- DO NOT ACCOUNT FOR MODULARITY, MODERN DIAGNOSTIC METHODS,  
BUILT-IN TEST

- DO NOT IMPACT DESIGN

### FIGURES OF MERIT HAVE UNDESIRABLE CHARACTERISTICS

## MAINTAINABILITY TECHNIQUES

### MAINTAINABILITY PREDICTION

MODERN MAINTAINABILITY PREDICTION TECHNIQUE PUBLISHED  
IN RADC-TR-78-169, MAINTAINABILITY PREDICTION AND ANALYSIS  
STUDY

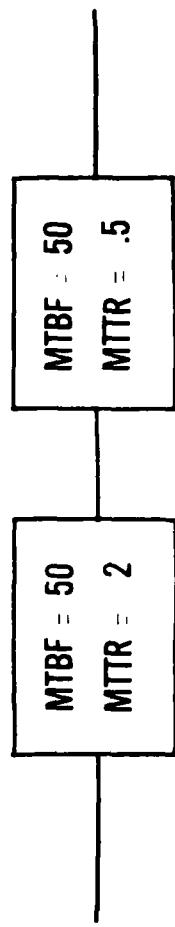
- APPLICABLE TO MODERN TECHNOLOGY
- CONTAINS METHOD FOR DESIGN TRADES

TO BE TRANSITIONED VIA MIL HDBK-472, MAINTAINABILITY  
PREDICTION

VALIDATION STUDIES SCHEDULED FOR FY-81

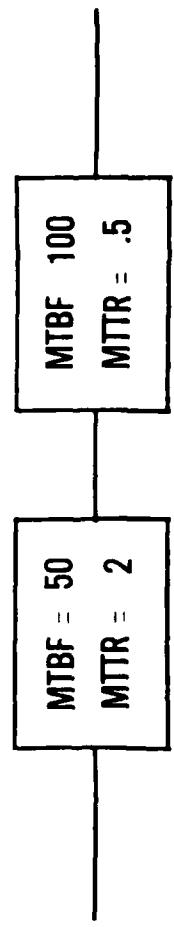
## MAINTAINABILITY TECHNIQUES

### COMPUTING SYSTEM MEAN TIME TO REPAIR



$$MTTR = 1/2 (2) + 1/2 (.5) = 1.25$$

IF RELIABILITY IMPROVES:



$$MTTR = 2/3 (2) + 1/3 (.5) = 1.5$$

••• MTTR CAN DEGRADE IF RELIABILITY IMPROVES

## MAINTAINABILITY TECHNIQUES

A BETTER APPROACH TO COMPUTING MAINTAINABILITY

MAINTENANCE HOURS/OPERATING HOUR

$$\frac{MRT}{MTBF} = \text{PER LRU}$$

$$\sum \frac{MRT}{MTBF} = \text{PER EQUIPMENT}$$

$$A = \frac{1}{1 + \sum \frac{MRT}{MTBF}}$$

- FIGURE IMPROVES AS EITHER RELIABILITY OR MAINTAINABILITY IMPROVE

- COMPUTATIONS ARE SIMPLIFIED

## MAINTAINABILITY TECHNIQUES

### RADC TESTABILITY PROGRAM

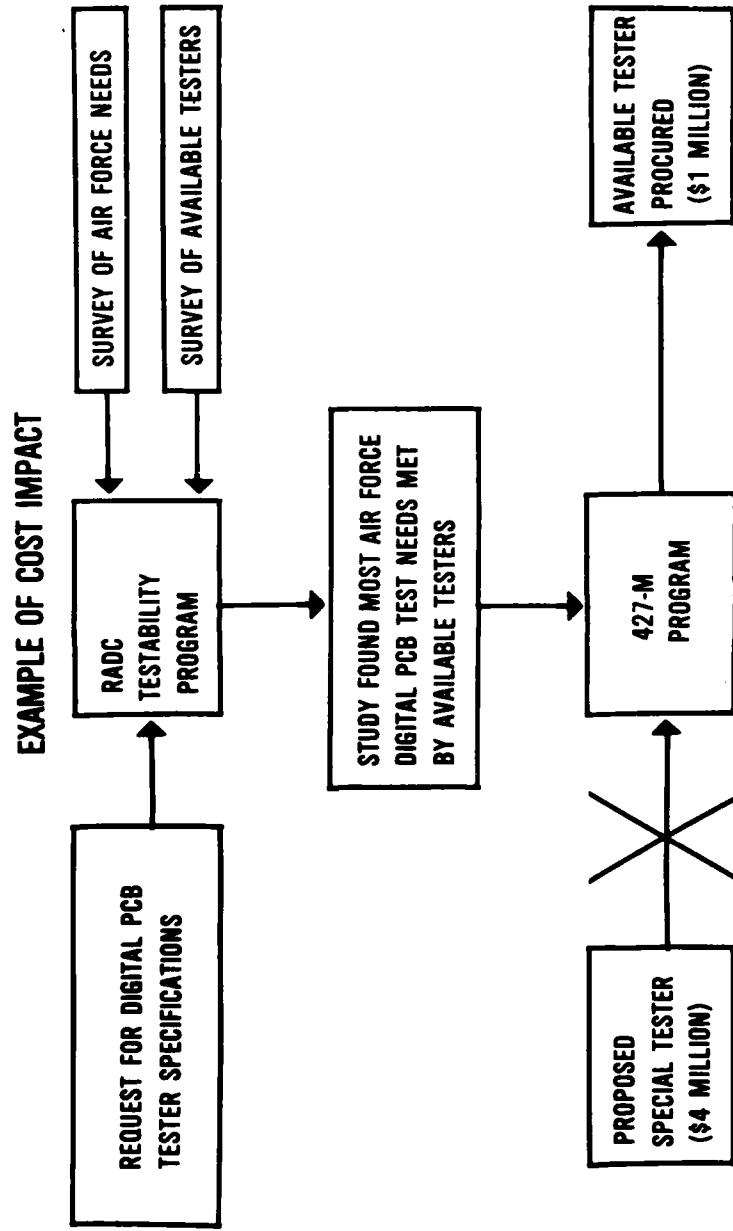
**RADC R&M MISSION:** DEVELOP METHODS FOR PREDICTING,  
DEMONSTRATING, & IMPROVING  
RELIABILITY & MAINTAINABILITY (R&M)

**TESTABILITY IMPACT:** MAINTAINABILITY PREDICTION &  
DEMONSTRATION TECHNIQUES MUST CONSIDER  
FAULT DETECTION & ISOLATION PARAMETERS  
(TESTABILITY)

**TESTABILITY STATUS:** A NEGLECTED ENGINEERING DISCIPLINE WITH A  
SIGNIFICANT IMPACT ON LIFE CYCLE COSTS

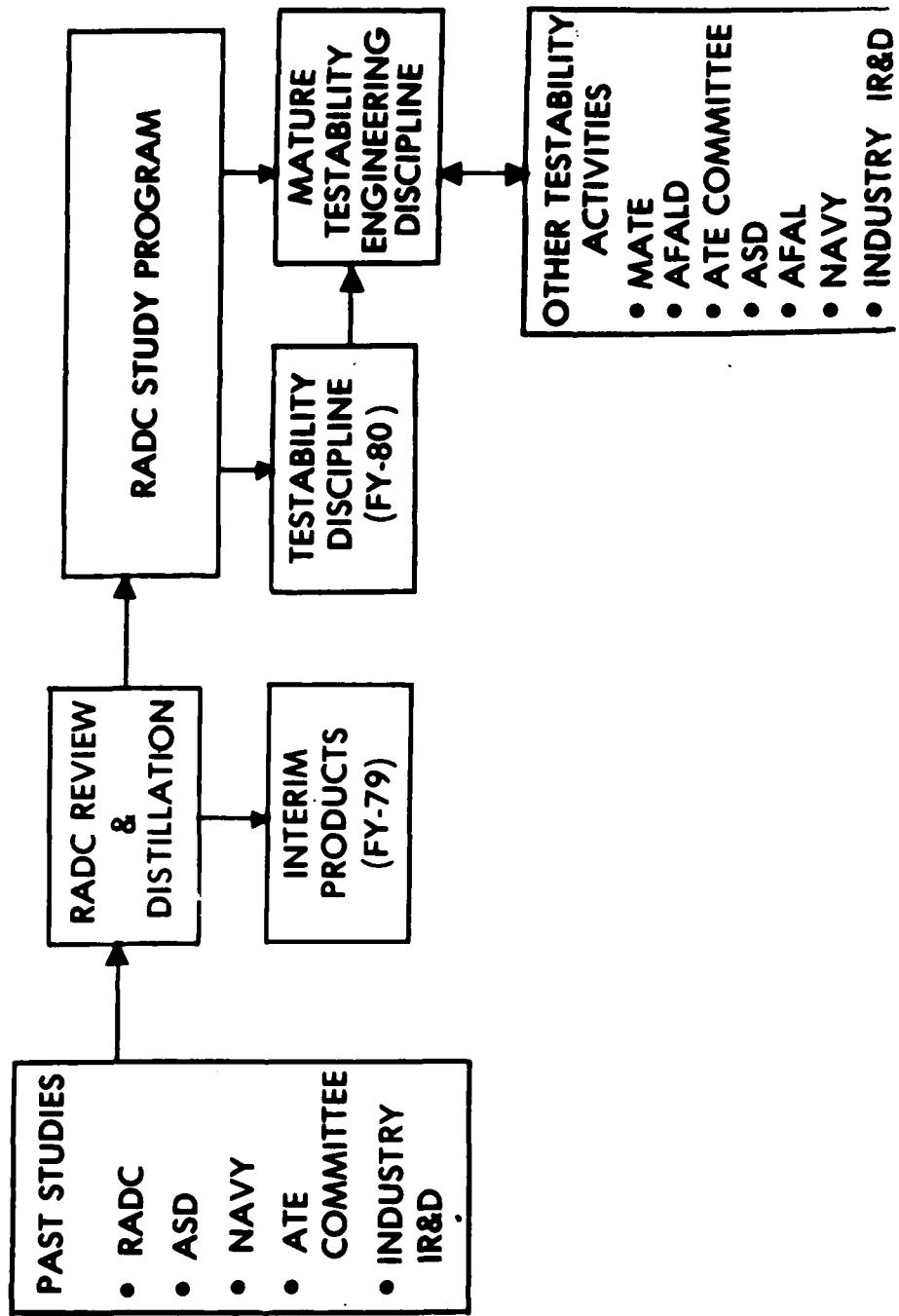
## MAINTAINABILITY TECHNIQUES

### RADC TESTABILITY PROGRAM



# MAINTAINABILITY TECHNIQUES

## RADC TESTABILITY PROGRAM



## MAINTAINABILITY TECHNIQUES

RADC TESTABILITY PROGRAM

### TESTABILITY DISCIPLINE NEEDS

TESTABILITY DISCIPLINE NEEDS	RADC PRODUCTS
<ul style="list-style-type: none"><li>• SPECIFYABLE FIGURES OF MERIT</li><li>• DEMONSTRATION METHODOLOGY</li></ul>	<ul style="list-style-type: none"><li>• BIT/EXTERNAL FIGURES OF MERIT AND DEMONSTRATION TECHNIQUES (RADC-TR-79-309)</li></ul>
<ul style="list-style-type: none"><li>• DESIGN TOOLS</li></ul>	<ul style="list-style-type: none"><li>• DESIGN GUIDELINES AND OPTIMIZATION PROCEDURES FOR TEST SUBSYSTEM DESIGN (RADC-TR-80-XXX)</li><li>• AN OBJECTIVE PRINTED CIRCUIT BOARD TESTABILITY DESIGN GUIDE AND RATING SYSTEM (RADC-TR-79-327)</li><li>• BIT-EXTERNAL TESTER RELIABILITY CHARACTERISTICS (RADC-TR-80-32)</li></ul>
<ul style="list-style-type: none"><li>• COST TRADE-OFFS</li></ul>	<ul style="list-style-type: none"><li>• OPERATION AND SUPPORT COST CHARACTERISTICS OF TESTERS AND TEST SUBSYSTEMS (RADC-TR-79-334)</li><li>• AVAILABILITY/OPERATIONAL READINES S TEST SUBSYSTEM COST TRADE-OFFS (RADC-TR-80-XXX)</li></ul>

## MAINTAINABILITY TECHNIQUES

### OTHER MAINTAINABILITY/TESTABILITY STUDIES

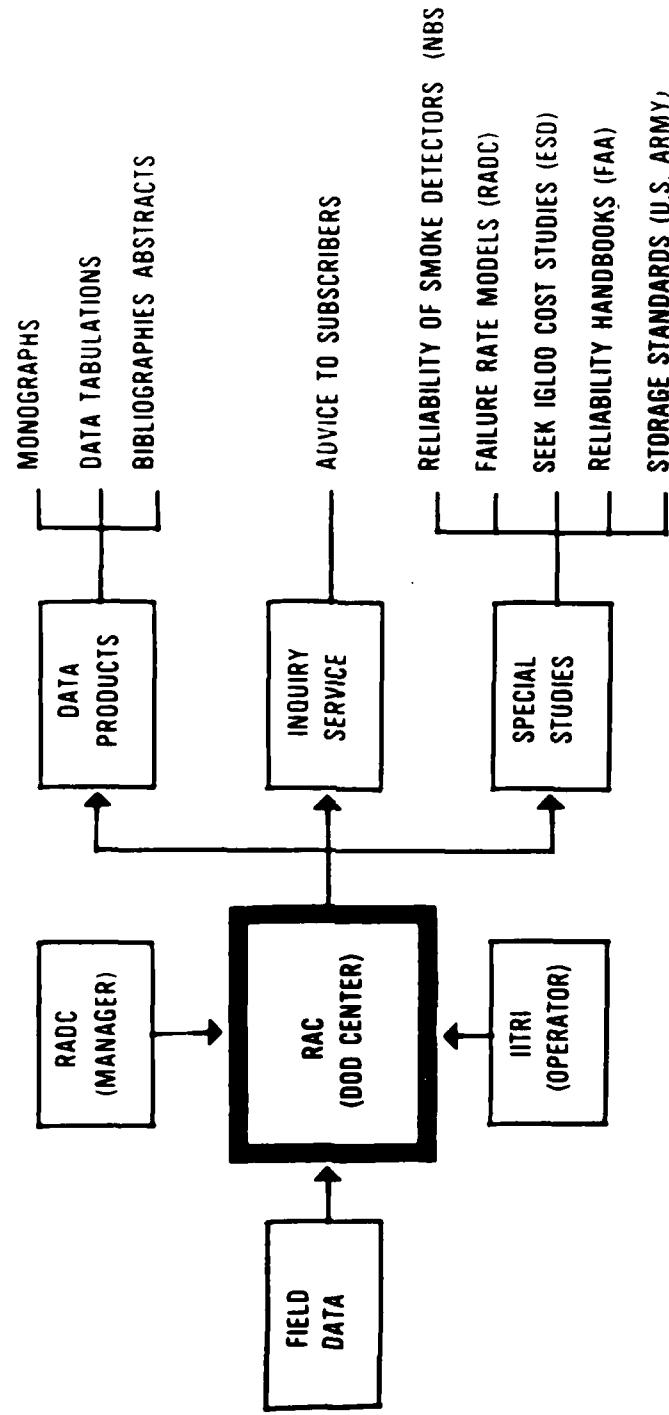
#### IN PROGRESS

- TESTABILITY NOTEBOOK
- FMEA METHODOLOGY
- CAUSES OF UNNECESSARY REMOVALS
- STUDY OF FALSE ALARMS

#### PLANNED FOR FY-81

- ANALYTICAL PROCEDURES FOR TESTABILITY
- FAULT TOLERANCE IN DISTRIBUTED SYSTEMS
- BIT HARDWARE/SOFTWARE TRADE-OFFS
- TESTER SOFTWARE COST ESTIMATION
- NON-ELECTRONIC COMPONENT TESTABILITY
- PROGRAMMABLE INTERFACES

## RELIABILITY ANALYSIS CENTER



**RADC EQUIPMENT/SYSTEM R&M PROGRAM**  
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## **RADC EQUIPMENT/SYSTEM R&M PROGRAM**

### **MILITARY STANDARDS AND HANDBOOKS**

**RADC IS DOD PREPARING ACTIVITY FOR:**

---

- MIL-HDBK-217 RELIABILITY PREDICTION OF ELECTRONIC EQUIPMENT**
- MIL-STD-470 MAINTAINABILITY PROGRAM REQUIREMENTS**
- MIL-STD-471 MAINTAINABILITY VERIFICATION/DEMONSTRATION/EVALUATION**
- MIL-STD-1591 ON AIRCRAFT FAULT DIAGNOSIS SUB-SYSTEMS ANALYSIS/SYNTHESIS OF**
- MIL-STD-001591 COMMAND, CONTROL AND COMMUNICATIONS (C<sup>3</sup>) SYSTEM & COMPONENT (USAF) FAULT DIAGNOSIS, SUBSYSTEMS, ANALYSIS/SYNTHESIS OF**

## RADC EQUIPMENT/SYSTEM R&M PROGRAM

### MILITARY STANDARDS AND HANDBOOKS

#### RADC IS AIR FORCE CUSTODIAN OF:

**MIL-STD-756** RELIABILITY PREDICTION

**MIL-STD-721** DEFINITION OF EFFECTIVENESS TERMS FOR RELIABILITY,  
MAINTAINABILITY, HUMAN FACTORS & SAFETY

**MIL-HDBK-472** MAINTAINABILITY PREDICTION

**MIL-STD-1629** PROCEDURES FOR PERFORMING A FMECA

#### RADC IS A REVIEWING ACTIVITY FOR:

**MIL-STD-781** RELIABILITY TESTS: EXPONENTIAL DISTRIBUTION

**MIL-STD-785** RELIABILITY PROGRAM FOR SYSTEMS & EQUIPMENT

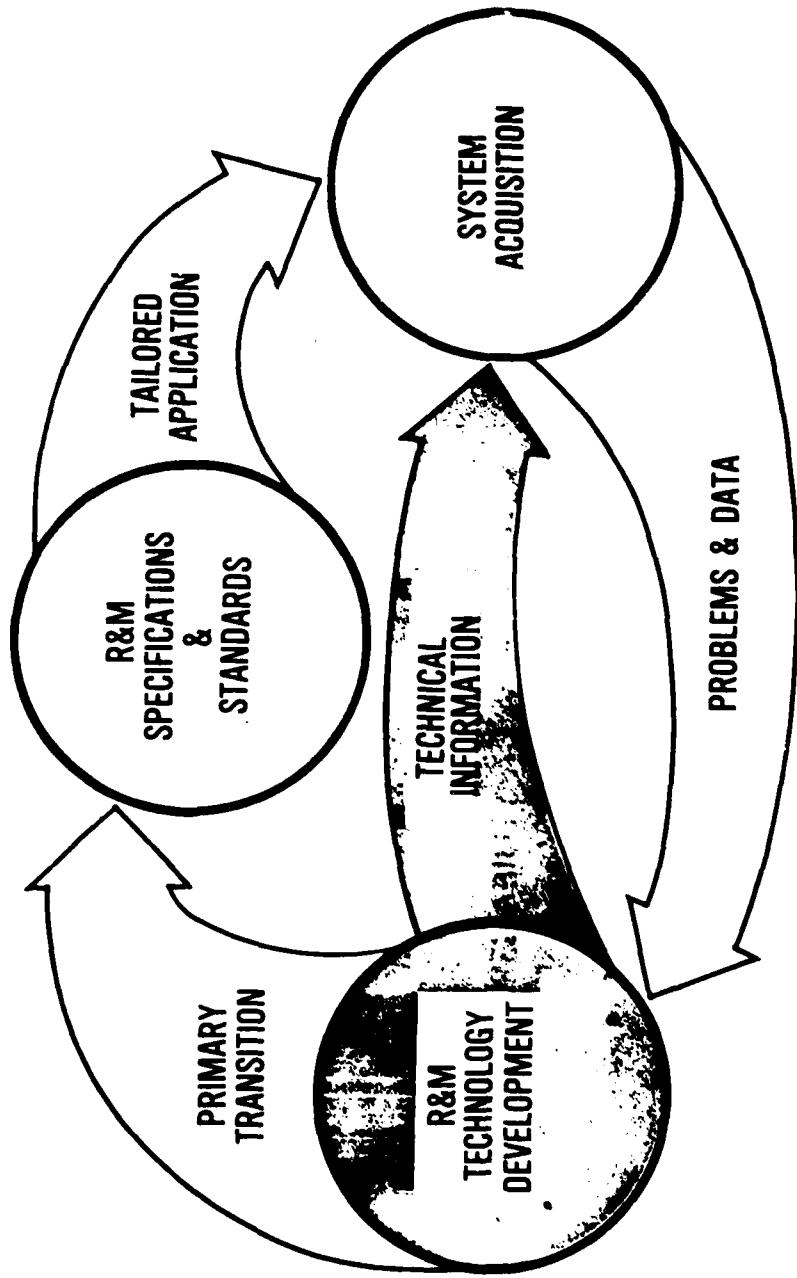
**ALL OTHER DOD R&M DOCUMENTS**

## **RADC EQUIPMENT/SYSTEM R&M PROGRAM**

### **R&M ENGINEERING SUPPORT**

- PREPARE R&M REQUIREMENTS
- EVALUATE PROPOSALS
- REVIEW R&M PROGRAM PLANS
- EVALUATE R&M PREDICTIONS
- MONITOR R&M PROGRAM
- REVIEW R&M DEMONSTRATION PLANS
- REVIEW & ANALYZE TEST RESULTS
- PROVIDE SPECIALIZED SERVICES

RADC EQUIPMENT / R&M SYSTEM PROGRAM  
SUMMARY



UNIQUE RADC CAPABILITY    RADC LEADING ROLE    MANY DIFFERENT AGENCIES

INDUSTRY LOOKS AT RADC 1980

SOFTWARE ENGINEERING SUB-THRUST - TPO 463

D. F. BERGSTROM  
SOFTWARE ENGINEERING SECTION  
ISIE/3227

AD-A088 341

ROME AIR DEVELOPMENT CENTER GRIFFISS AFB NY  
INDUSTRY LOOKS AT RADC - 1980, VOLUME III.(U)

1980

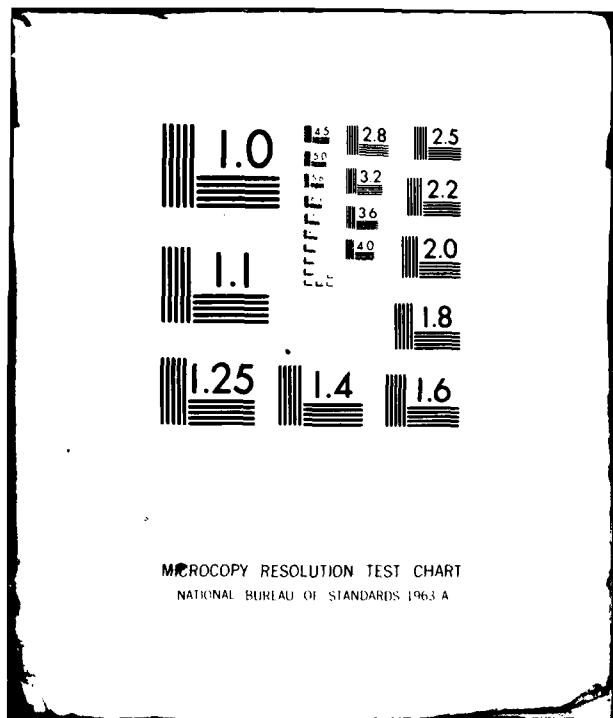
UNCLASSIFIED RADC-TR-80-195-VOL-3

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TP0/THRUST: 46 INFORMATION PROCESSING

SUB-THRUST: 463 SOFTWARE ENGINEERING

PROGRAM GOALS: DEVELOP AND EXPLOIT SOFTWARE ENGINEERING TECHNOLOGY FOR IMPROVED SYSTEM PERFORMANCE, QUALITY, AND RELIABILITY. ENFORCE ENGINEERING DISCIPLINE FOR SOFTWARE PRODUCTION AND TAKE ADVANTAGE OF MODERN PROGRAMMING PRACTICES. IMPROVE MANAGEMENT VISIBILITY INTO THE SOFTWARE LIFE CYCLE.

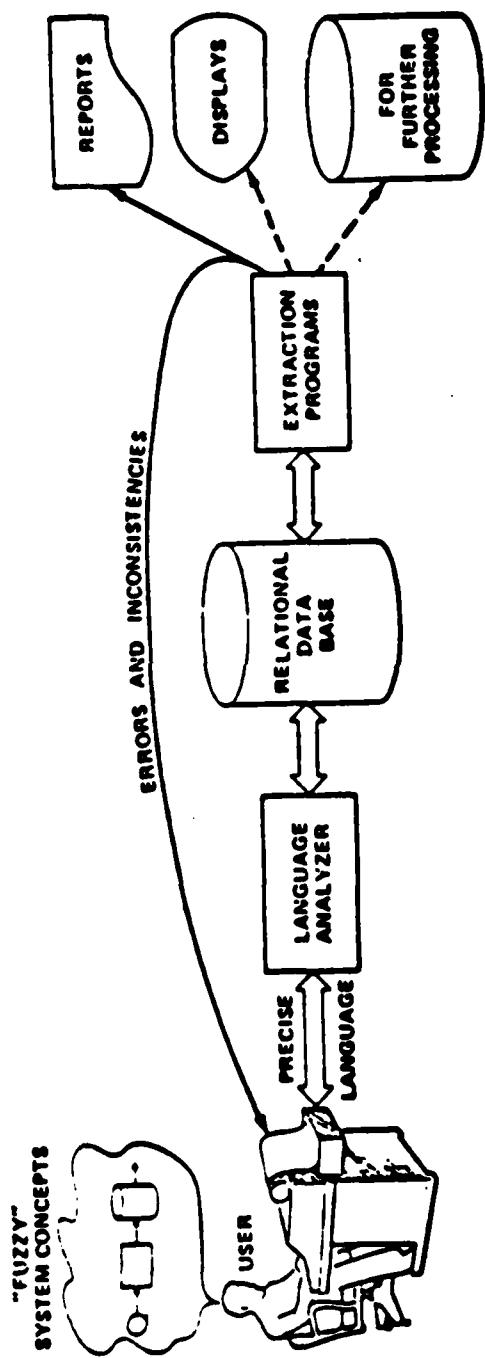
TECHNICAL AREAS:

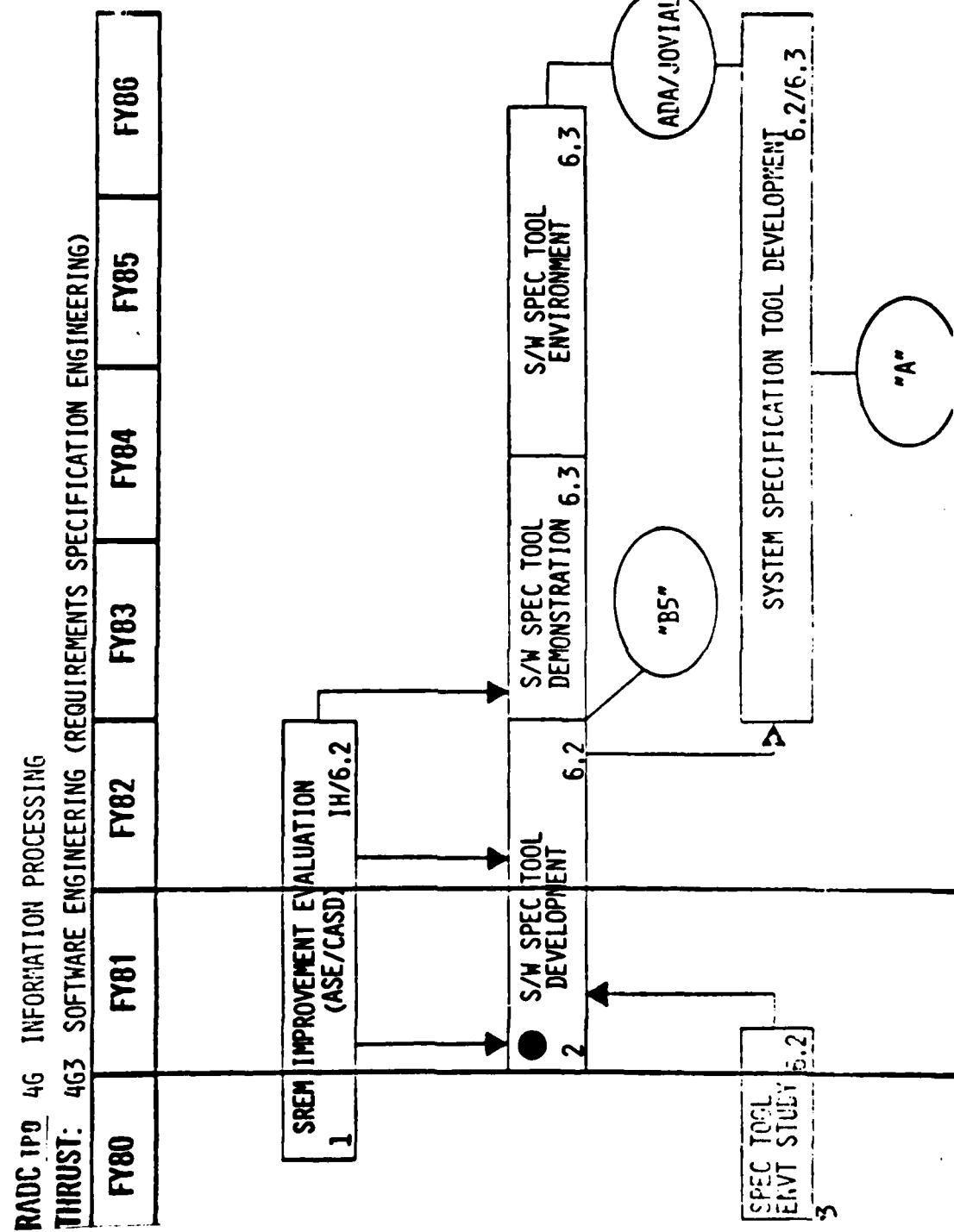
- REQUIREMENTS SPECIFICATION ENGINEERING
- DESIGN AND MANAGEMENT
- SOFTWARE TOOLS
- STANDARDS
- DATA COLLECTION
- MODELING
- QUALITY MEASUREMENTS

REQUIREMENTS SPECIFICATION ENGINEERING

- AUTOMATED REQUIREMENTS ANALYSIS TECHNOLOGY HAS POTENTIAL FOR GREATEST LEVERAGE IN REDUCING SYSTEM LIFE CYCLE COSTS.
- PROGRAM BASELINE - SRM SELECTED AS MOST SUITABLE TECHNOLOGY FOR SOFTWARE AND SYSTEM REQUIREMENTS ANALYSIS.

REQUIREMENTS SPECIFICATION FROM INFERRING





TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING  
SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (REQUIREMENTS SPECIFICATION ENGINEERING)  
EFFORT BLOCK TITLE: SOFTWARE SPECIFICATION TOOL DEVELOPMENT

OBJECTIVE:

- DEVELOP METHODOLOGY AND TOOLS FOR AUTOMATED REQUIREMENTS SPECIFICATION ANALYSIS.
- PROVIDE CAPABILITY TO VALIDATE MIL-STD 490 TYPE B5 SPECIFICATIONS.

TECHNICAL APPROACH:

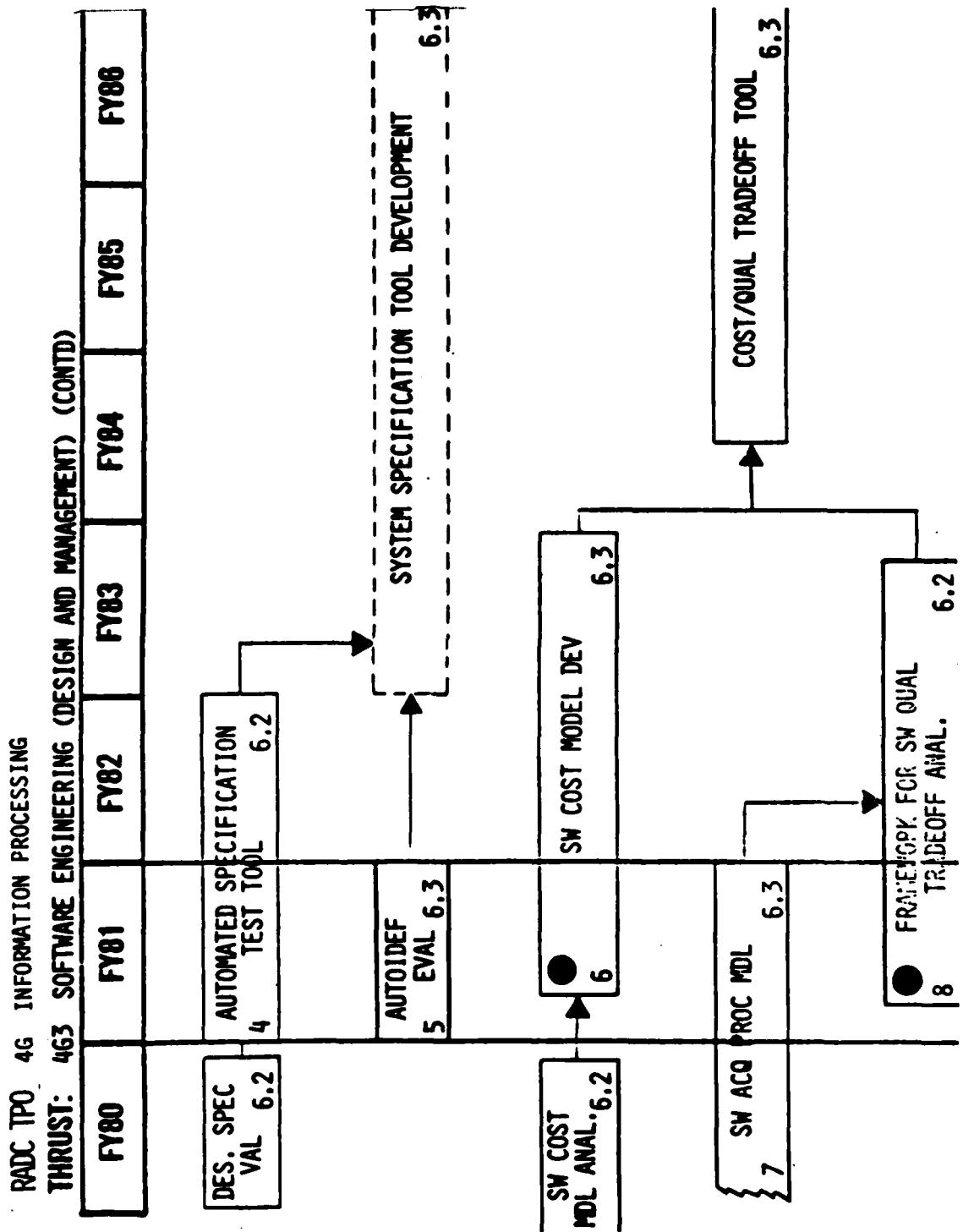
- UTILIZE SRM AS BASELINE TECHNOLOGY.
- ENHANCEMENTS FOR C3I EMBEDDED COMPUTER SYSTEMS.

PAY OFF:

- INTEGRATED SET OF SPECIFICATION EVALUATION TOOLS.
- LIFE CYCLE COST REDUCTION - EARLY DETECTION/CORRECTION OF SPECIFICATION PROBLEMS.
- CONSISTENT, COMPLETE, UNAMBIGUOUS SPECIFICATIONS.

### DESIGN AND MANAGEMENT

- MERGE ADVANCED DESIGN TECHNIQUES WITH AUTOMATED REQUIREMENTS SPECIFICATION TECHNOLOGY.
- PROVIDE MANAGEMENT CAPABILITY TO PREDICT SOFTWARE LIFE CYCLE COSTS.
- DEVELOP TECHNIQUES TO PERFORM COST/PERFORMANCE TRADEOFFS DURING SYSTEM CONCEPT AND VALIDATION PHASES.



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (DESIGN AND MANAGEMENT)

EFFORT BLOCK TITLE: SOFTWARE COST MODEL DEVELOPMENT

OBJECTIVE: DEVELOP ADVANCED MODELS FOR PREDICTING SOFTWARE LIFE CYCLE COSTS.

TECHNICAL APPROACH:

- UTILIZE RESULTS OF ONGOING STATE-OF-THE-ART ANALYSIS.
- SELECT AND DEVELOP "BEST FIT" COST MODEL(S).
- VALIDATE MODEL USING ACTUAL SOFTWARE COST DATA.

PAY OFF:

- IMPROVED CAPABILITY TO ESTIMATE LIFE CYCLE COSTS DURING CONCEPT/VALIDATION PHASES.
- AVOID UNANTICIPATED COST OVERRUNS.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING, DESIGN AND MANAGEMENT

EFFORT BLOCK TITLE: FRAMEWORK FOR SOFTWARE QUALITY TRADE-OFF ANALYSIS

OBJECTIVE: DEVELOP CAPABILITY TO PERFORM SOFTWARE COST VS. QUALITY TRADE-OFFS.

TECHNICAL APPROACH:

- SIMULATE SOFTWARE ACQUISITION LIFE CYCLE.
- INCLUDE CAPABILITY TO VARY DEVELOPMENT APPROACHES.
- INTEGRATE LIFE CYCLE COST MODELS AND QUALITY FACTOR CRITERIA.

PAY OFF:

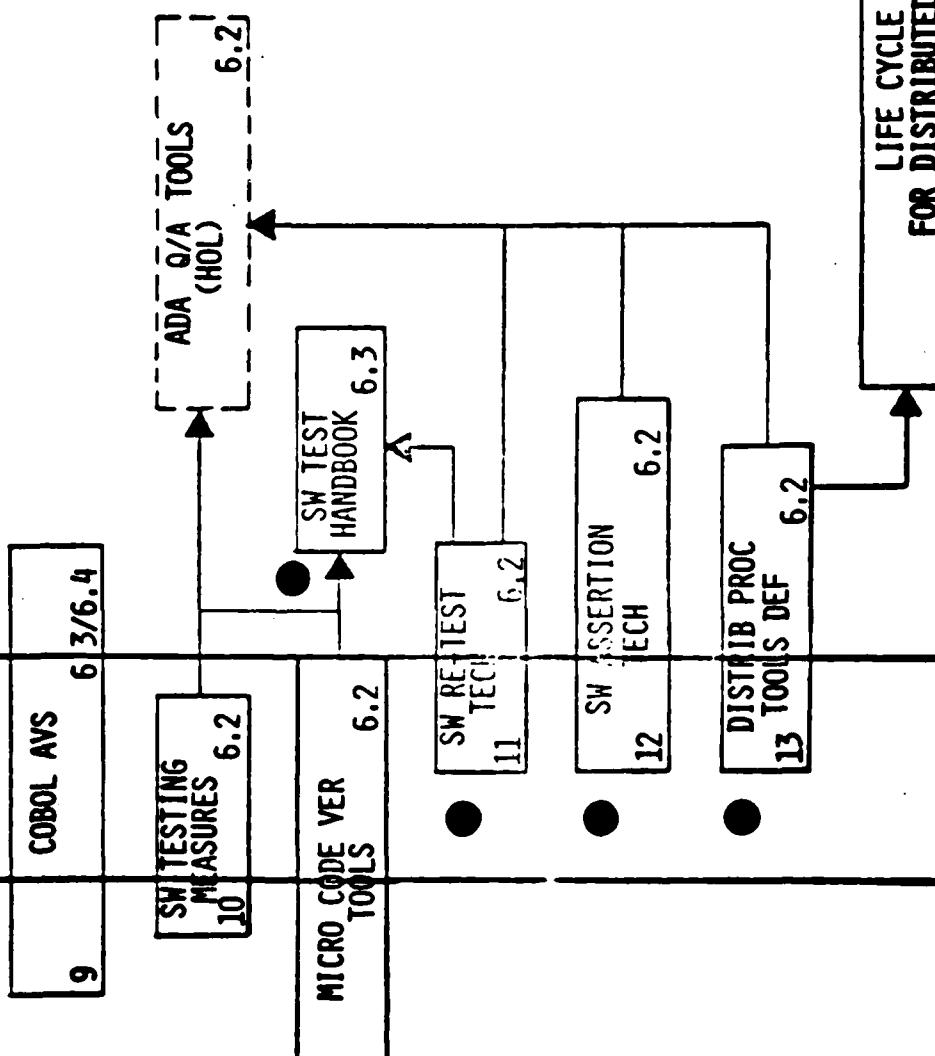
- COST/QUALITY TRADE-OFF STUDIES DURING CONCEPT AND VALIDATION PHASE.
- CAPABILITY TO SELECT FROM ALTERNATIVE DEVELOPMENT APPROACHES.
- MATCH SELECTED APPROACH TO AVAILABLE RESOURCES.

SOFTWARE TOOLS

- DEVELOP SOFTWARE TESTING TOOLS AND PROCEDURES TO OBTAIN MORE EFFECTIVE TESTING PER AF DOLLAR.
- PROVIDE APPLICATION PROGRAM TEST GUIDANCE TO OPTIMIZE TESTING APPROACH.
- INVESTIGATE AND DEVELOP SOFTWARE TOOLS TO COPE WITH UNIQUE ATTRIBUTES OF DISTRIBUTED SYSTEMS.

<u>TPO/THRUST #/TITLE:</u>	<u>46 INFORMATION PROCESSING</u>
<u>SUB-THRUST #/TITLE:</u>	<u>463 SOFTWARE ENGINEERING (SOFTWARE TOOLS)</u>
<u>EFFORT BLOCK TITLE:</u>	<u>SOFTWARE TEST HANDBOOK</u>
<u>OBJECTIVE:</u>	<u>PRODUCE HANDBOOK TO MATCH SOFTWARE TESTING APPROACH TO APPLICATION ENVIRONMENT.</u>
<u>TECHNICAL APPROACH:</u>	<ul style="list-style-type: none"><li>• DETERMINE APPLICABLE COST-EFFECTIVE TECHNIQUES AND TOOLS.</li><li>• DEVELOP STEP-WISE METHODOLOGY FOR APPLYING TEST METHODS.</li></ul>
<u>PAY OFF:</u>	<ul style="list-style-type: none"><li>• HANDBOOK PROVIDES FOCUS ON SOFTWARE TEST METHODOLOGY.</li><li>• SOFTWARE TEST GUIDANCE AND IMPROVED TEST STRATEGY.</li></ul>

RADC TPO 4G INFORMATION PROCESSING		463 SOFTWARE ENGINEERING (SOFTWARE TOOLS) (CONTD)		
THRUST:	FY80	FY81	FY82	FY83



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (SOFTWARE TOOLS)

EFFORT BLOCK TITLE: SOFTWARE RE-TEST TECHNIQUES

OBJECTIVE: IMPROVE SOFTWARE RE-TEST METHODS FOR IMPLEMENTED SYSTEMS.

TECHNICAL APPROACH:

- EXAMINE REQUIREMENTS FOR SOFTWARE RE-TEST DURING OPERATION AND MAINTENANCE PHASE.
- DETERMINE APPLICABLE STATE-OF-THE-ART METHODS.
- SPECIFY NEW OR AUGMENTED TECHNOLOGIES FOR SOFTWARE RE-TEST.

PAY OFF:

- IMPROVEMENTS TO SOFTWARE SUPPORT ACTIVITIES - MODIFICATION AND ERROR CORRECTION.
- ACCOMMODATE SOFTWARE MAINTENANCE "RIPPLE EFFECT".

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (SOFTWARE TOOLS)

EFFORT BLOCK TITLE: SOFTWARE ASSERTION TECHNIQUES

OBJECTIVE: DEVELOP PROGRAM ASSERTION TECHNIQUES FOR IMPROVED SOFTWARE TESTING.

TECHNICAL APPROACH:

- INVESTIGATE PROGRAM ASSERTION METHODOLOGY FOR AUTOMATED TEST TOOLS.
- DEVELOP SUITABLE ASSERTION METHODS COMPATIBLE WITH KNOWN TESTING METHODS.
- VALIDATE TECHNIQUES USING AUTOMATED VERIFICATION SYSTEM (E.G. CAVS).

PAY OFF:

- IMPROVED SOFTWARE TESTABILITY AND PERFORMANCE.
- DYNAMIC TESTING OF SOFTWARE SYSTEMS SUPPORTED.
- HIGHER QUALITY OF DELIVERED PRODUCT.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (SOFTWARE TOOLS)

EFFORT BLOCK TITLE: DISTRIBUTED PROCESSING TOOLS DEFINITION

OBJECTIVE: TO IDENTIFY/SPECIFY TOOLS AND TECHNIQUES TO SUPPORT THE DEVELOPMENT OF DISTRIBUTED PROCESSING SYSTEMS.

TECHNICAL APPROACH:

- INVESTIGATE ATTRIBUTES OF DISTRIBUTED PROCESSING SYSTEMS AND APPLICABILITY OF EXISTING TOOLS.
- DEFINE IMPROVED METHODS FOR ALLOCATION OF SYSTEM FUNCTIONS.
- IDENTIFY NEEDS FOR NEW PROGRAMMING STRATEGIES.
- PROVIDE FUNCTIONAL REQUIREMENTS FOR NECESSARY TECHNOLOGY DEVELOPMENTS.

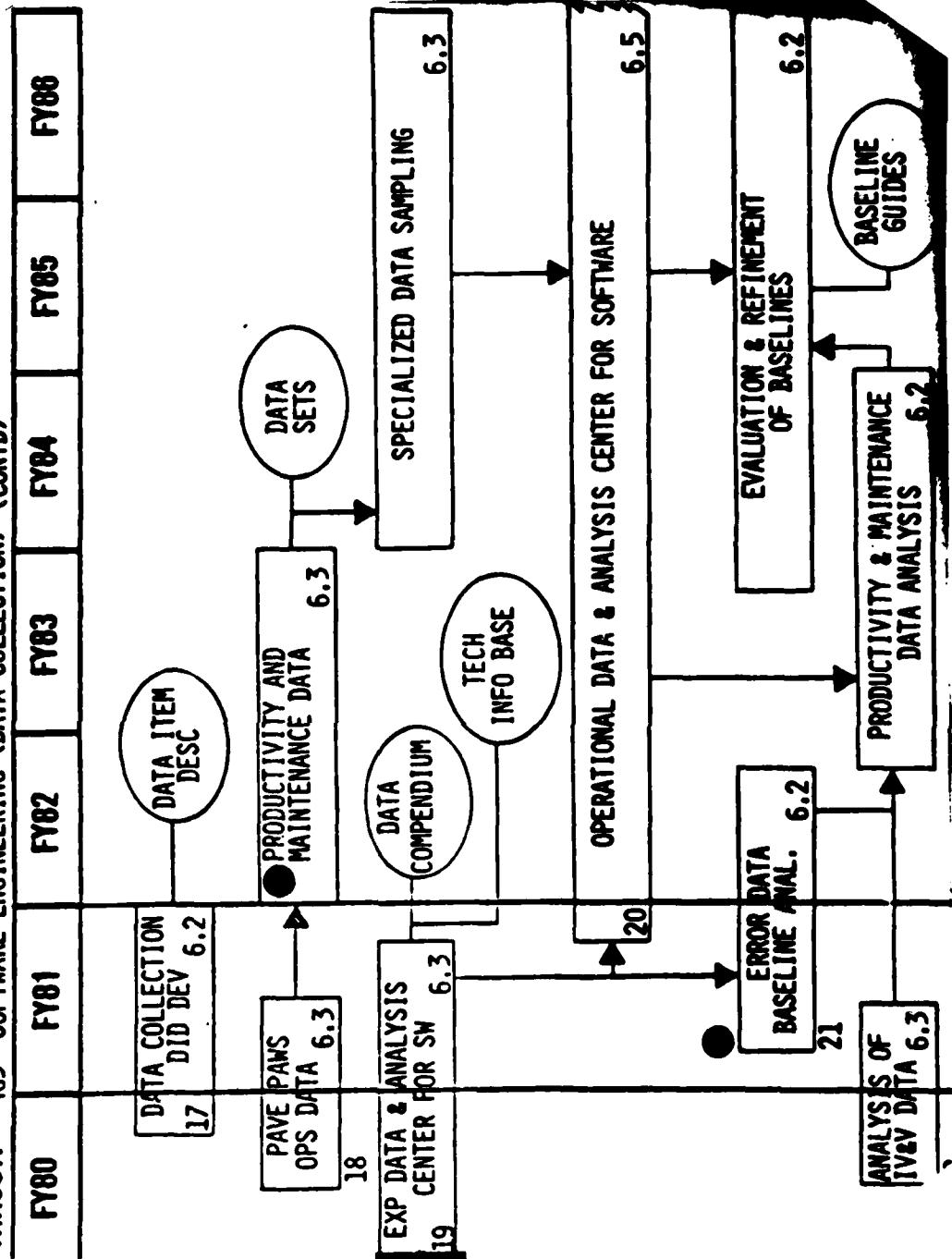
PAY OFF:

- COHERENT SOFTWARE DEVELOPMENT APPROACH FOR DISTRIBUTED PROCESSING.
- TECHNOLOGY TRANSFER OF EXISTING SOFTWARE ENGINEERING CAPABILITIES.

DATA COLLECTION

- ESTABLISH A FOCAL POINT CENTER FOR THE RECEIPT AND ANALYSIS OF SOFTWARE DATA FOR USE BY MANAGERS AND TECHNOLOGISTS.
- PROVIDE STANDARDIZED DATA COLLECTION METHODOLOGY.
- SUPPORT SOFTWARE ENGINEERING RESEARCH OBJECTIVES.

ADC IPO 4G INFORMATION PROCESSING  
 THRUST: 463 SOFTWARE ENGINEERING (DATA COLLECTION) (CONTD)



TP0/THRUST #/TITLE: 4G INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (DATA COLLECTION)

EFFORT BLOCK TITLE: PRODUCTIVITY AND MAINTENANCE DATA

OBJECTIVE: TO ACQUIRE SOFTWARE DATA, IN A CONTINUING BASIS, TO SUPPORT SOFTWARE ENGINEERING RESEARCH OBJECTIVES.

TECHNICAL APPROACH:

- IDENTIFY DATA REQUIREMENTS - F.G. TO SUPPORT MAPPING, PLANNING, AND DESIGN REQUIREMENTS.
- SELECT APPROPRIATE PROJECTS FOR DATA COLLECTION.
- APPLY DATA ITEM DESCRIPTION FOR STANDARDIZATION AND MAINTENANCE.

PAY OFF:

- ENABLE THE EVALUATION OF IMPROVED SOFTWARE ENGINEERING TECHNIQUES.
- PROVIDE DIRECTION FOR FUTURE RESEARCH ACTIVITIES.

TP0/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (DATA COLLECTION)

EFFORT BLOCK TITLE: ERROR DATA BASELINE ANALYSIS

OBJECTIVE: DEVELOP BASELINES TO TRACK AND ASSESS RELIABILITY OF SOFTWARE SYSTEMS  
DURING DEVELOPMENT.

TECHNICAL APPROACH:

- UTILIZE DATA FROM EXPERIMENTAL DACS AND ANALYSIS OF IV&V DATA EFFORT.
- DEVELOP ERROR PROFILES AND BASELINES FOR CATEGORIZED C3I SYSTEMS.

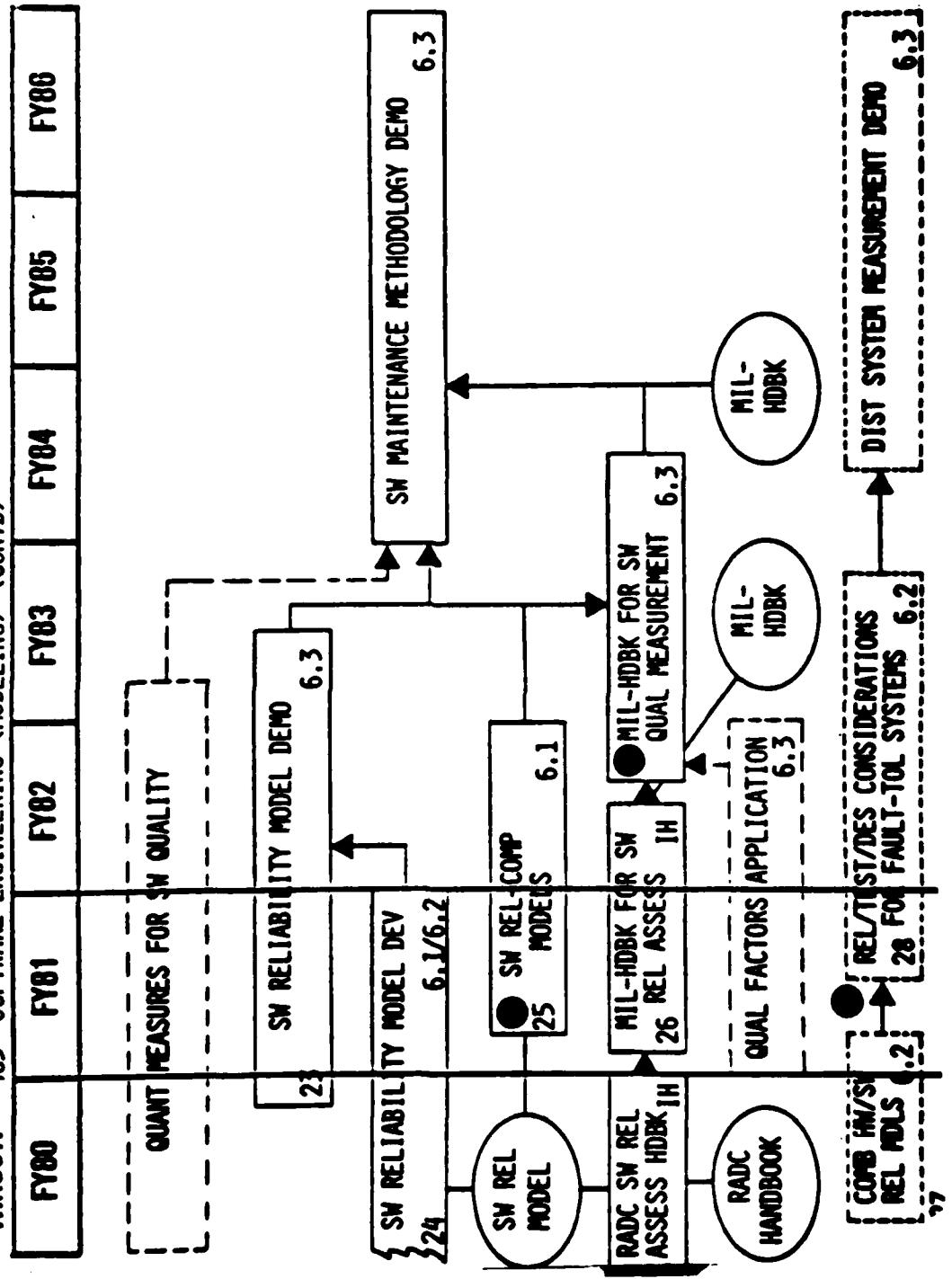
PAY OFF:

- PROVIDES CAPABILITY TO ASSESS IMPACT OF NEW SOFTWARE ENGINEERING TECHNOLOGY.
- IMPROVED REFERENCES FOR VALIDATING SOFTWARE QUALITY MEASUREMENTS.

MODELING

- PROVIDE A CAPABILITY TO PREDICT SYSTEM PERFORMANCE CHARACTERISTICS.
- ESTABLISH GUIDES, STANDARDS, AND SPECIFICATIONS FOR ASSESSING IMPLEMENTED SYSTEM PERFORMANCE DURING VARIOUS LIFE CYCLE PHASES.
- DEVELOP MODELS TO ASSIST SOFTWARE ENGINEERING RESEARCH.

RADC TPO 46 INFORMATION PROCESSING  
THRUST: 463 SOFTWARE ENGINEERING (MODELING) (CONT'D)



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (MODELING)

EFFORT BLOCK TITLE: SOFTWARE RELIABILITY-COMPLEXITY MODELS

OBJECTIVE: TO DEVELOP MODELS OF THE SOFTWARE DEVELOPMENT PROCESS THROUGH THE FORMULATION OF INTEGRATED SOFTWARE RELIABILITY AND COMPLEXITY MODELS.

TECHNICAL APPROACH:

- EXAMINE SOFTWARE STRUCTURAL COMPLEXITY.
- RELATE COMPLEXITY TO SOFTWARE RELIABILITY AND DEVELOPMENT.

PAY OFF:

- CAPABILITY TO PERFORM RELIABILITY/COMPLEXITY TRADEOFFS.
- ASSISTANCE IN PERFORMING SOFTWARE TASK PARTITIONING.

1PO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (MODELING)

11: FORT BLOCK TITLE: MIL-HDBK FOR SOFTWARE QUALITY MEASUREMENT

OBJECTIVE: DEVELOP MIL-HDBK FOR PERFORMING SOFTWARE QUALITY MEASUREMENTS.

TECHNICAL APPROACH:

- AUGMENT MIL-HDBK FOR SOFTWARE RELIABILITY ASSESSMENT WITH RESULTS FROM SOFTWARE QUALITY FACTORS APPLICATION.
- PRODUCE MIL-HDBK FOR SOFTWARE QUALITY MEASUREMENTS.

11: 11:

- CAPABILITY TO SPECIFY REQUIRED SOFTWARE QUALITY FACTORS (E.G. RELIABILITY).
- MIL-HDBK PROVIDES FOCUS ON SOFTWARE QUALITY.

TPO/THRUST #/TITLE: 4G INFORMATION PROCESSING

SUB-THRUST #/TITLE: 4G3 SOFTWARE ENGINEERING (MODELING)

EFFORT BLOCK TITLE: RELIABILITY/TEST/DESIGN CONSIDERATIONS FOR FAULT TOLERANT SYSTEMS.

OBJECTIVE: INVESTIGATE HARDWARE/SOFTWARE ASPECTS OF FAULT TOLERANT SYSTEMS TO IMPROVE RELIABILITY AND TESTABILITY.

TECHNICAL APPROACH:

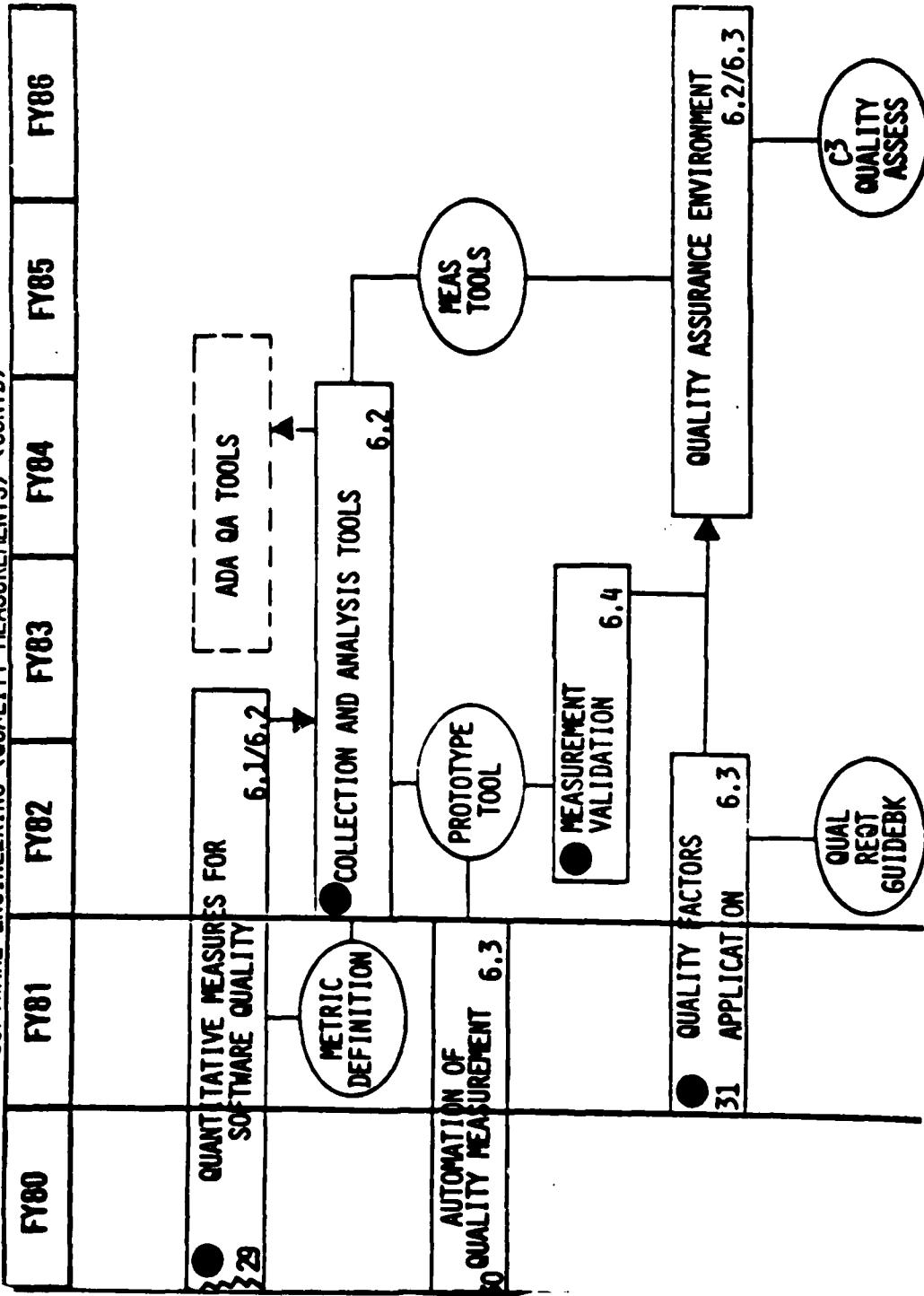
- COMBINED HARDWARE/SOFTWARE MODELING ACTIVITY.
- DEVELOP NEW METHODS TO EVALUATE AND TEST FAULT TOLERANT SYSTEMS.
- JOINT DEVELOPMENT - RADC/IS AND RB.

PAY OFF: IMPROVED SYSTEM RELIABILITY AND TESTABILITY.

### QUALITY MEASUREMENTS

- PROVIDE ACQUISITION MANAGEMENT WITH A CAPABILITY TO PREDICT COST/QUALITY/PERFORMANCE TRADEOFFS.
- ESTABLISH THE PROPER METRICS AND TOOLS FOR QUALITATIVE AND QUANTITATIVE ANALYSIS OF SOFTWARE SYSTEMS.
- DEVELOP AUTOMATED TOOLS FOR COLLECTING AND ANALYZING METRIC DATA AND VALIDATE THE RESULTS.

RADC TPO 4G INFORMATION PROCESSING  
 THRUST: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENTS) (CONT'D)



ITPO/THRUST #/TITLE: 46 INFORMATION PROCESSING  
SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENTS)

EFFORT BLOCK TITLE: QUANTITATIVE MEASURES FOR SOFTWARE QUALITY

OBJECTIVE: TO DEVELOP SPECIFIC METRICS OF SOFTWARE ATTRIBUTES AND INTERRELATIONSHIPS OF QUALITY FACTORS SUCH AS MAINTAINABILITY, REUSABILITY, INTEROPERABILITY, ETC.

TECHNICAL APPROACH:

- ANALYZE APPLICATION ENVIRONMENTS AND CLASSIFY SOFTWARE DEVELOPMENTS.
- EMPIRICAL DATA ANALYSIS TO DETERMINE SOFTWARE QUALITY MEASURES.
- CRITICAL SOFTWARE ATTRIBUTES SPECIFIED.

PAY OFF:

- IMPROVED UNDERSTANDING OF SOFTWARE QUALITY METRICS.
- ABILITY TO MATCH SOFTWARE METRICS TO DESIRED SYSTEM FEATURES (E.G. PORTABILITY).

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING  
SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENTS)  
EFFORT BLOCK TITLE: COLLECTION AND ANALYSIS TOOLS  
OBJECTIVE: IMPLEMENT AUTOMATED DATA COLLECTION AND ANALYSIS TOOLS FOR PERFORMING  
SOFTWARE QUALITY MEASUREMENTS.

TECHNICAL APPROACH:

- UTILIZE PROTOTYPE COBOL TOOL FOR DATA COLLECTION.
- INITIAL VALIDATION OF MEASUREMENTS AND TEST RESULTS.
- DEVELOP METHODS FOR PREDICTING SOFTWARE QUALITY.

PAY OFF: IMPROVED SOFTWARE QUALITY ASSURANCE.

IPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENTS).

EFFORT BLOCK TITLE: MEASUREMENT VALIDATION

OBJECTIVE: TO APPLY AND DEMONSTRATE SOFTWARE QUALITY MEASUREMENT TOOLS IN AN AIR FORCE ACQUISITION PROGRAM.

TECHNICAL APPROACH:

- CANDIDATE COBOL PROJECT SELECTED (H6109/FCOS ENVIRONMENT).
- COLLECT AND ANALYZE METRIC DATA USING PROTOTYPE TOOL.

PAY OFF:

- CAPABILITY TO PREDICT AND ASSESS SOFTWARE QUALITY.
- VALIDATED COLLECTION TOOL TO PROVIDE R&D BASIS FOR ADDITIONAL TOOLS FOR VARIOUS PROGRAMMING LANGUAGES.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING  
SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENT)  
EFFORT BLOCK TITLE: QUALITY FACTORS APPLICATION  
OBJECTIVE: PROVIDE A CAPABILITY FOR ACQUISITION MANAGEMENT TO SPECIFY SOFTWARE QUALITY.

TECHNICAL APPROACH:

- DEMONSTRATE INTERACTION BETWEEN VARIOUS SOFTWARE QUALITY FACTORS.
- SURVEY C3I ENVIRONMENT TO PRIORITIZE QUALITY REQUIREMENTS.
- CONDUCT TRADE-OFF STUDIES OF CRITICAL SOFTWARE ATTRIBUTES.
- PRODUCE A QUALITY REQUIREMENTS GUIDEBOOK.

PAY OFF:

- EFFECTIVE SPECIFICATION OF KEY SOFTWARE QUALITY REQUIREMENTS.
- GUIDANCE DIRECTLY USABLE BY MANAGEMENT.
- MEANS FOR ASSURING ADHERENCE TO QUALITY REQUIREMENTS.

INDUSTRY LOOKS AT RANC 1980

SOFTWARE ENGINEERING

TPO 463

<u>AREA</u>	<u>PROGRAM MANAGER</u>	<u>SYMBOL/PHONE</u>
REQUIREMENTS SPECIFICATION ENGINEERING	W. PZEPKA	ISIE/7834
SOFTWARE DESIGN	P. WERER	ISIE/7834
MANAGEMENT	A. SUKERT	ISIS/3851
SOFTWARE TOOLS	F. LAMONICA	ISIE/7834
DATA COLLECTION	J. PALAIM	ISIS/4325
MODELING	A. SUKERT	ISIS/3851
QUALITY MEASUREMENTS	J. CAVANO	ISIS/4325

ELECTROMAGNETIC COMPATIBILITY

- CONTROL - T. BAUSTERT
- ANALYSIS & PREDICTION - G. CAPRARI

## **EMC CONTROL**

### **OBJECTIVE:**

**DEVELOP ADVANCED CONTROL/SUPPRESSION TECHNIQUES  
TO ALLEVIATE INTERFERENCE PROBLEMS NOT SOLVABLE BY  
CONVENTIONAL TECHNIQUES**

TPO/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST:	4F3 EM COMPATIBILITY - CONTROL
BLOCK TITLE:	EMC TECHNOLOGY FOR ADVANCED COMMUNICATIONS 12
OBJECTIVE:	ADVANCE ELECTRONICALLY TUNABLE RESONATOR (ETR) TECHNOLOGY
TECHNICAL APPROACH:	<ul style="list-style-type: none"><li>• HIGH POWER SUB-BAND UHF COVERAGE ETR</li><li>• MEDIUM POWER FULL BAND COVERAGE ETR</li></ul>
PAY OFF:	IMPROVED COLLOCATION ON C <sup>3</sup> I PLATFORMS

TPO/THRUST #/TITLE:

SUB-THRUST:

BLOCK TITLE:

OBJECTIVE:

TECHNICAL APPROACH:

PAY OFF:

4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY

4F3 EM COMPATIBILITY - CONTROL

ADVANCED SYNTHESIZER EMC TECHNOLOGY 13

DEVELOP ELECTRONICALLY TUNABLE OSC (ETO) TECHNOLOGY  
FOR NEW SYNTHESIZER APPLICATION

PROVE FEASIBILITY OF HIGH LEVEL/LOW NOISE ETO  
USE ETO TECH TO DEVELOP A # LOCKED LOOP SYNTHESIZER

REDUCE XMTR NOISE/SURPIUS OUTPUTS

REDUCE RCVR GUARDBANDS

PROVIDE TECH SPIN-OFF TO TEST EQUIPMENT

TPO/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST:	4F3 EM COMPATIBILITY - CONTROL
BLOCK TITLE:	HF ANTENNA COUPLER EMC TECHNOLOGY
OBJECTIVE:	DEVELOP TECHNOLOGY TO REDUCE ANTENNA COUPLER NONLINEAR INTERFERENCE
TECHNICAL APPROACH:	<ul style="list-style-type: none"><li>IDENTIFY INTERFERENCE MECHANISM</li><li>REDUCE INTERFERENCE BY DESIGN</li><li>DEVELOP ADD-ON DEVICE</li></ul>
PAY OFF:	HF XTR/AFSATCOM EMC WITHOUT FREQUENCY MANAGEMENT

TPO/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST:	4F3 EM COMPATIBILITY - CONTROL
BLOCK TITLE:	EMC TECHNOLOGY FOR REDUCING NONLINEAR INTERFERENCE 16
OBJECTIVE:	DEVELOP TECHNOLOGY TO IDENTIFY AND REDUCE NONLINEAR GENERATED INTERFERENCE
TECHNICAL APPROACH:	STUDY MECHANISMS AND ID TECHNIQUES NONLINEAR CANCELLATION TECHNIQUE ADAPT & CONTROL NONLINEAR SYNTHESIS
PAY OFF:	COLLOCATION OF ULTRA SENSITIVE RVRS ON C <sup>3</sup> I PLATFORMS

TPO/THRUST #/TITLE: 4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY

SUB-THRUST: 4F3 EM COMPATIBILITY - CONTROL

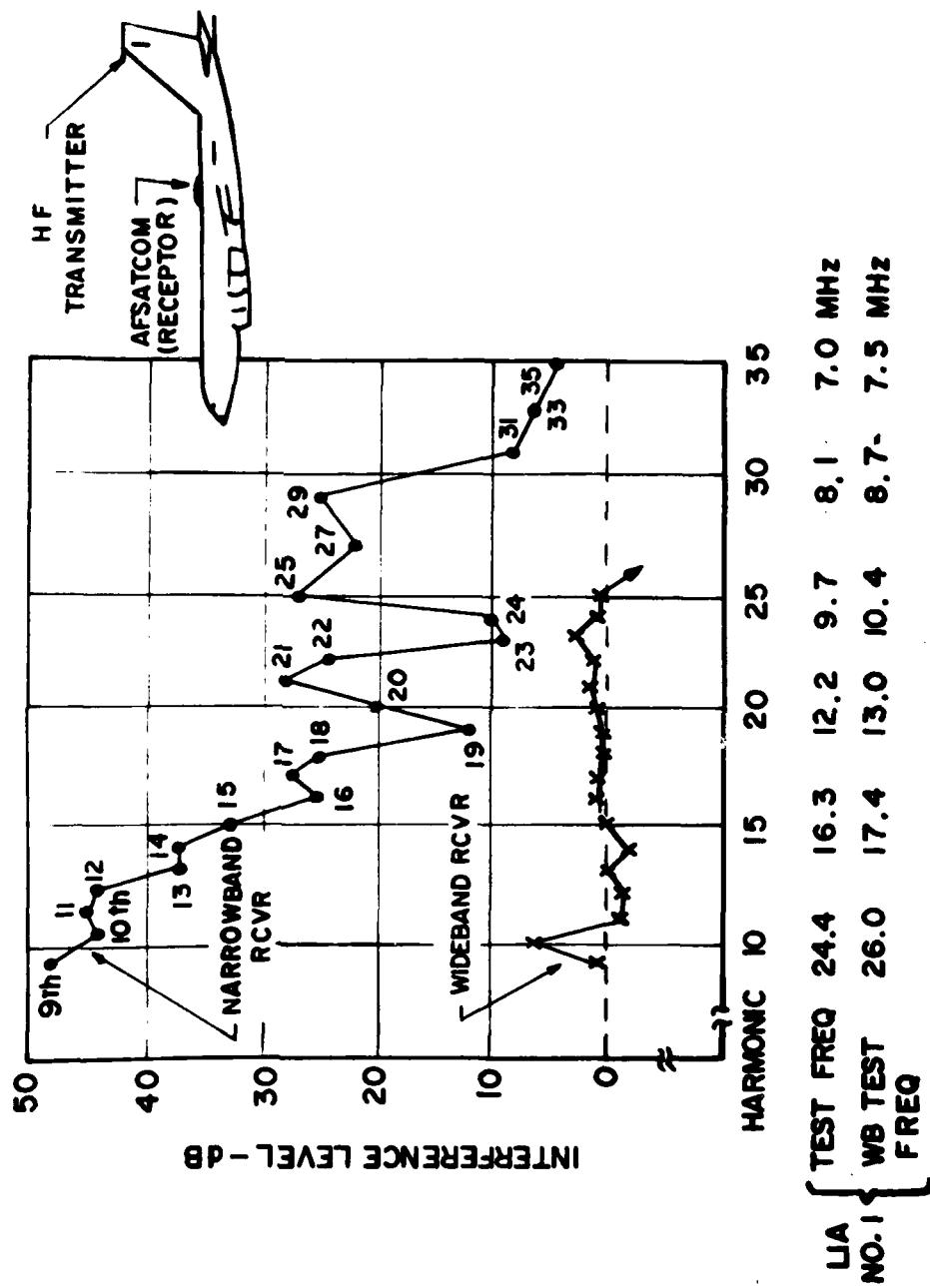
BLOCK TITLE: COMPUTER AIDED EMC DESIGN TECHNIQUES 17

OBJECTIVE: DEVELOP GENERALIZED PRINTED CIRCUIT LAYOUT, GROUNDING  
AND BY-PASS TECHNIQUES TO REDUCE UNWANTED COUPLING PATHS

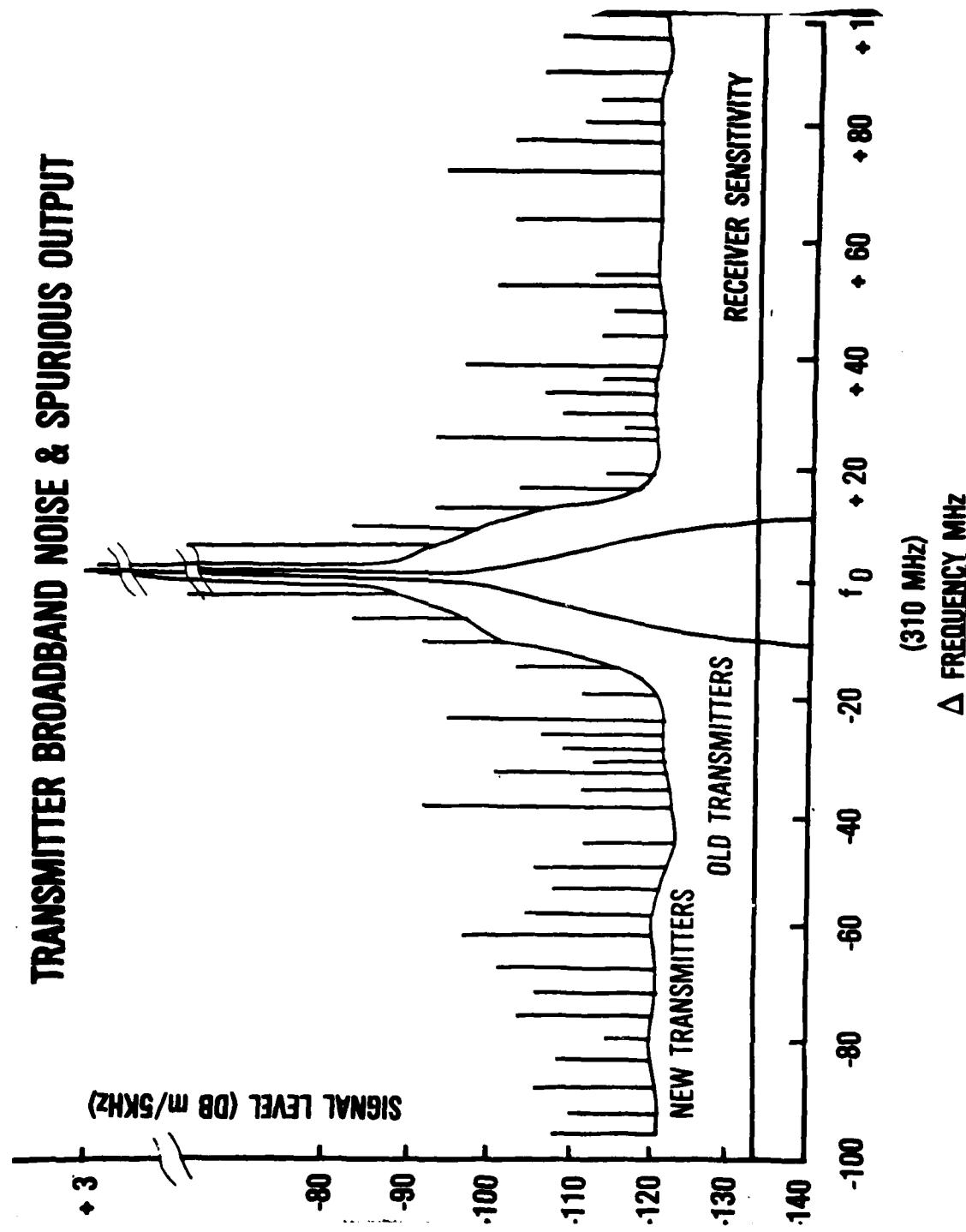
TECHNICAL APPROACH: INVESTIGATE UNWANTED COUPLING MECHANISMS AND PROVIDE  
COMPUTER AIDED DESIGN ALTERNATIVES

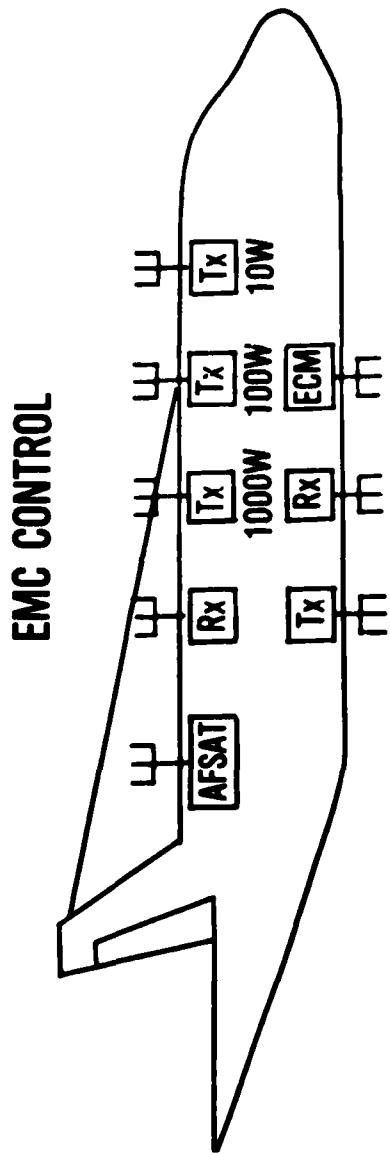
PAY OFF:  HANDHELD CALCULATOR PROGRAMS  
 UPDATE AFSC DH 1-4 EMC

## AN/ARC-58 LIAISON NO.1 AS A SOURCE



### TRANSMITTER BROADBAND NOISE & SPURIOUS OUTPUT





EMC CONTROL

## Tx Outputs

- DESIRED OUTPUT
- NOISE
- SPURIOUS
- HARMONICS
- IM PRODUCTS

## MEDIUM

DIRECT PATH  
REFLECTED PATH  
FUSELAGE  
NON-LINEAR  
APERTURES

## Rx INPUTS

- DESIRED SIGNAL
- BRUTE FORCE
- NOISE
- SPURIOUS
- HARMONICS

## Rx OUTPUT

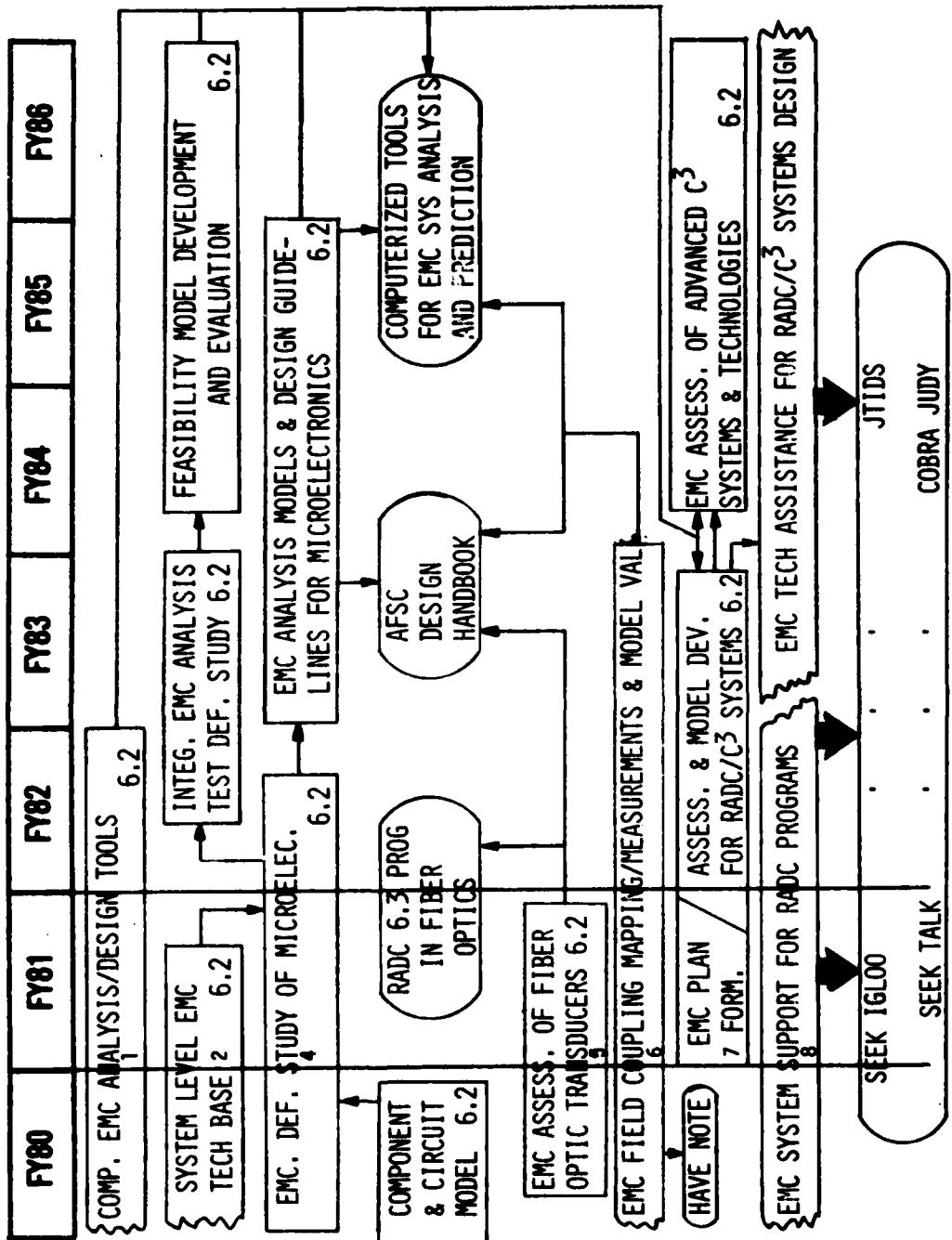
- L.O. SIGNAL
- SPURIOUS
- IM PRODUCTS
- HARMONICS

EMC ANALYSIS, PREDICTION AND MEASUREMENT

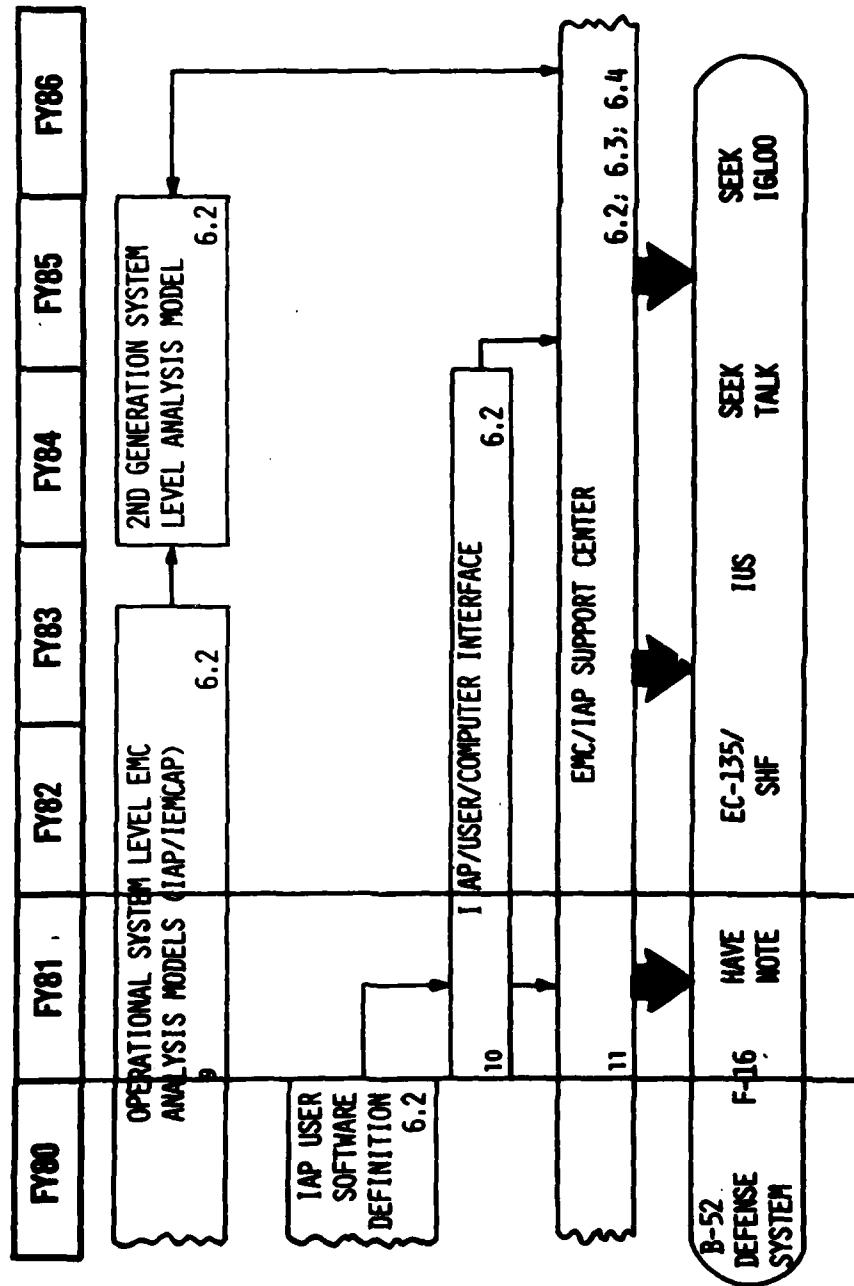
THE OBJECTIVE OF THIS TECHNICAL AREA IS:

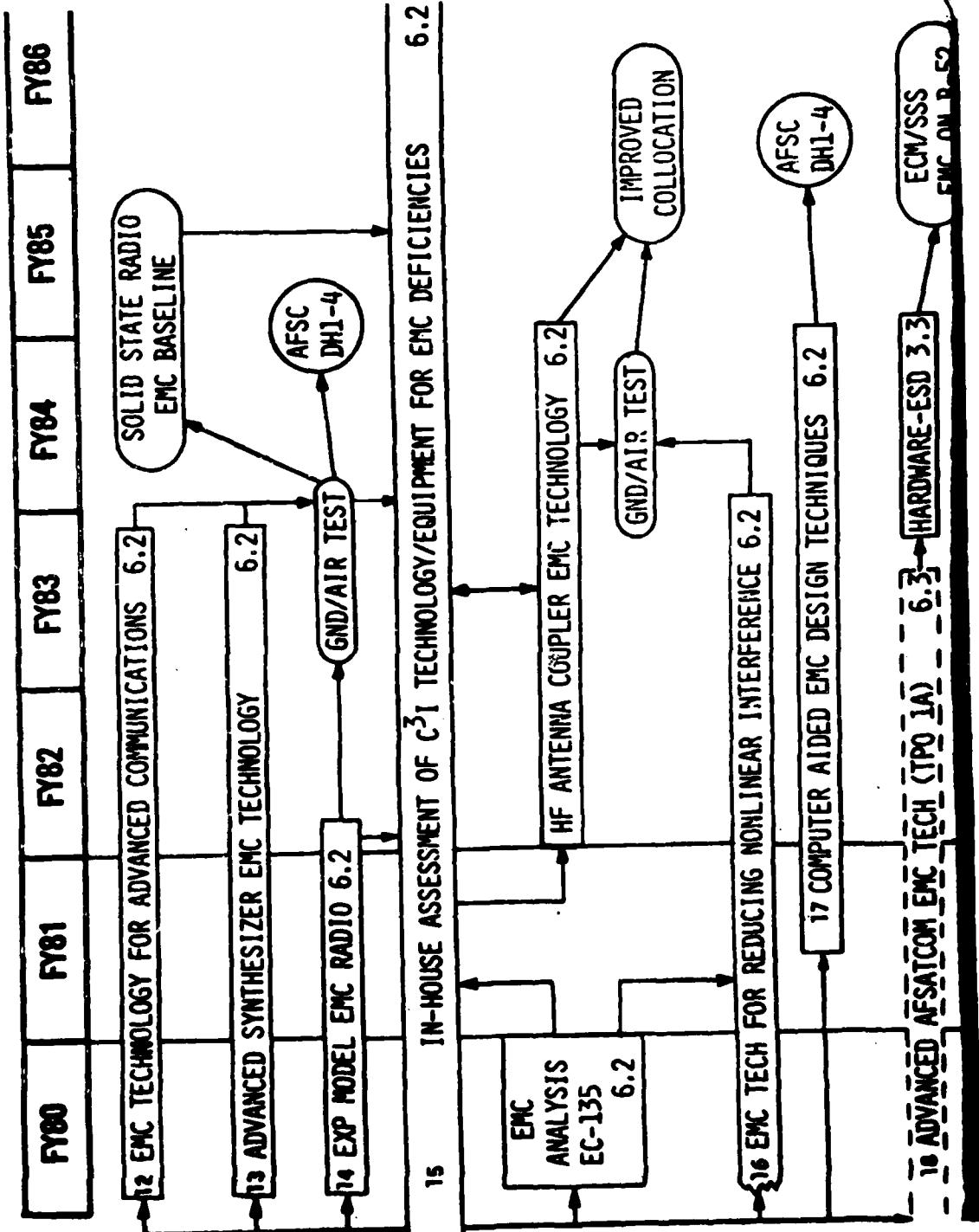
1. TO CONDUCT LONG RANGE CONTINUING RESEARCH AND SYSTEM'S ANALYSIS FOR USE IN DEVELOPING RECOMMENDATIONS AND TECHNIQUES TO EFFICIENTLY UTILIZE THE EM SPECTRUM IN A COMPATIBLE MANNER.
2. TO EMPHASIZE RESEARCH, DEVELOPMENT, TEST AND EVALUATION EVOLVING MODELING TECHNIQUES FOR COMPONENTS, CIRCUITS, EQUIPMENTS, SUB-SYSTEMS AND SYSTEMS DESIGN THROUGHOUT THEIR LIFE CYCLE.
3. TO ENSURE THE EFFICIENT AND BROAD EXCHANGE OF THE INFORMATION OBTAINED REGARDING THE RESULTS OF THIS AREA.

RADC TPO 4F3 - EM COMPATIBILITY



RADC TPO 4F3 - EM COMPATIBILITY





TP0/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST #/TITLE:	4F3 EM COMPATIBILITY
BLOCK TITLE:	EMC DEFINITION STUDY OF MICROELECTRONICS 4
OBJECTIVE:	<ul style="list-style-type: none"> <li>DETERMINE EM SUSCEPTIBILITY OF USAF MICROELECTRONIC CIRCUITRY</li> <li>ESTABLISH INTERFERENCE MECHANISMS</li> <li>DEVELOP USABLE ANALYTICAL MODELS AND/OR DESIGN GUIDELINES</li> </ul>
TECHNICAL APPROACH:	<ul style="list-style-type: none"> <li>ANALYTICAL/EXPERIMENTAL INVESTIGATION</li> <li>ESTABLISH &amp; DEFINE MODELING LEVEL</li> <li>DEVELOP MULTI-PARAMETER SUSCEPTIBILITY MODEL</li> <li>STUDY IMPACT TO C<sup>3</sup> SYSTEMS VIA COMPUTER MODELS AND DESIGN HANDBOOKS</li> <li>IMPLEMENT ONE OR MORE MODELS IN SOFTWARE AND IN HANDBOOKS</li> </ul>
PAY OFF:	PREDICTION/ANALYSIS COMPUTER MODELS FOR MICROELECTRONICS AND C <sup>3</sup> SYSTEMS; REDUCED EMC COSTS; EMC DESIGN PROCEDURES FOR MICROELECTRONICS

TP0/THRUST #/TITLE: 4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY

SUB-THRUST #/TITLE: 4F3 EM COMPATIBILITY

BLOCK TITLE: INTEGRATED EMC ANALYSIS/TEST DEFINITION STUDY

OBJECTIVE: DEFINE INTERFACING OF EMC MEASUREMENTS, COMPUTERIZED ANALYSIS TOOLS, AND THEIR RESPECTIVE DATA

TECHNICAL APPROACH:

- DEFINE BOX LEVEL MEASUREMENT HARDWARE AND SOFTWARE
- DEFINE SYSTEM LEVEL MEASUREMENT HARDWARE AND SOFTWARE
- DEFINE INTERFACING OF BOX AND SYSTEM LEVEL DATA WITH ANALYSIS TOOLS

PAY OFF:

- EFFICIENT DATA GATHERING PROCEDURES
- EFFICIENT DATA UTILIZATION
- MORE EM COMPATIBLE WEAPON SYSTEMS

TPD/THRUST #/TITLE: 4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY

SUB-THRUST #/TITLE: 4F3 EM COMPATIBILITY

BLOCK TITLE: EMC FIELD COUPLING MAPPING/MEASUREMENTS & MODEL VALIDATION 6

OBJECTIVE:

- DEMONSTRATE CAPABILITIES & DEFINE LIMITS OF FINITE DIFFERENCE TIME DOMAIN (FDTD)/COUPLING INTO MISSILES
- INTERFACE ADVANCED COUPLING TECHNIQUES
- MEASURE E&H FIELDS IN MISSILES

TECHNICAL APPROACH:

- MODEL ARBITRARY ANGLES OF INCIDENCE & POLARIZATION
- MODEL WIRES BEHIND APERTURES
- DEVELOP INTERFACE SOFTWARE TECHNIQUES
- DEVELOP E&H FIELD PROBES WITH ACCURACY OF  $\pm 1$  DB AND SPATIAL RESOLUTION OF  $\pm 0.5$  CM

PAY-OFF:

ACCURATE TECHNIQUES FOR PREDICTING/VERIFYING EM FIELDS INTO MISSILES

TOP/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST #/TITLE:	4F3 EM COMPATIBILITY
BLOCK TITLE:	OPERATIONAL SYSTEM LEVEL EMC ANALYSIS MODELS (IAP/IEMCAP) 9
OBJECTIVE:	UPGRADE IEMCAP CAPABILITY TO ADDRESS DEFICIENCIES SURFACED BY USERS, F-15 AND B-52 EVALUATIONS, & OTHER CURRENT & PROJECTED APPLICATIONS
TECHNICAL APPROACH:	DEVELOP, INCORPORATE INTO IEMCAP, AND DOCUMENT: <ul style="list-style-type: none"> <li>● IMPROVED SPECTRA AND RECEPTOR MODELS</li> <li>● ANTENNA OUT-OF-BAND MODELS</li> <li>● NONLINEAR ANALYSIS</li> <li>● EFFECTS OF WIRE HANGERS, JUNCTION BOXES, BULKHEADS</li> <li>● BUND E-TO-BUNDLE COUPLING</li> <li>● BOX-TO-BOX COUPLING</li> </ul>
PAY OFF:	HIGHLY IMPROVED TOOL FOR PRELIMINARY EMC ANALYSIS/DESIGN; REDUCE COSTLY EMC TESTS; PROVIDE STANDARD WEAPON SYSTEM EMC DATA BASE FOR FUTURE SYSTEM MODS

IEMCAP

SUPPLEMENTAL MODELS

P-STATIC

TEMPEST

MAGNETOSPHERIC SUBSTORMS

LIGHTNING

OFF-LINE MODELS

NONLINEAR CIRCUIT ANALYSIS

EM FIELDS AND COUPLING ANALYSIS

WIRE COUPLING ANALYSIS

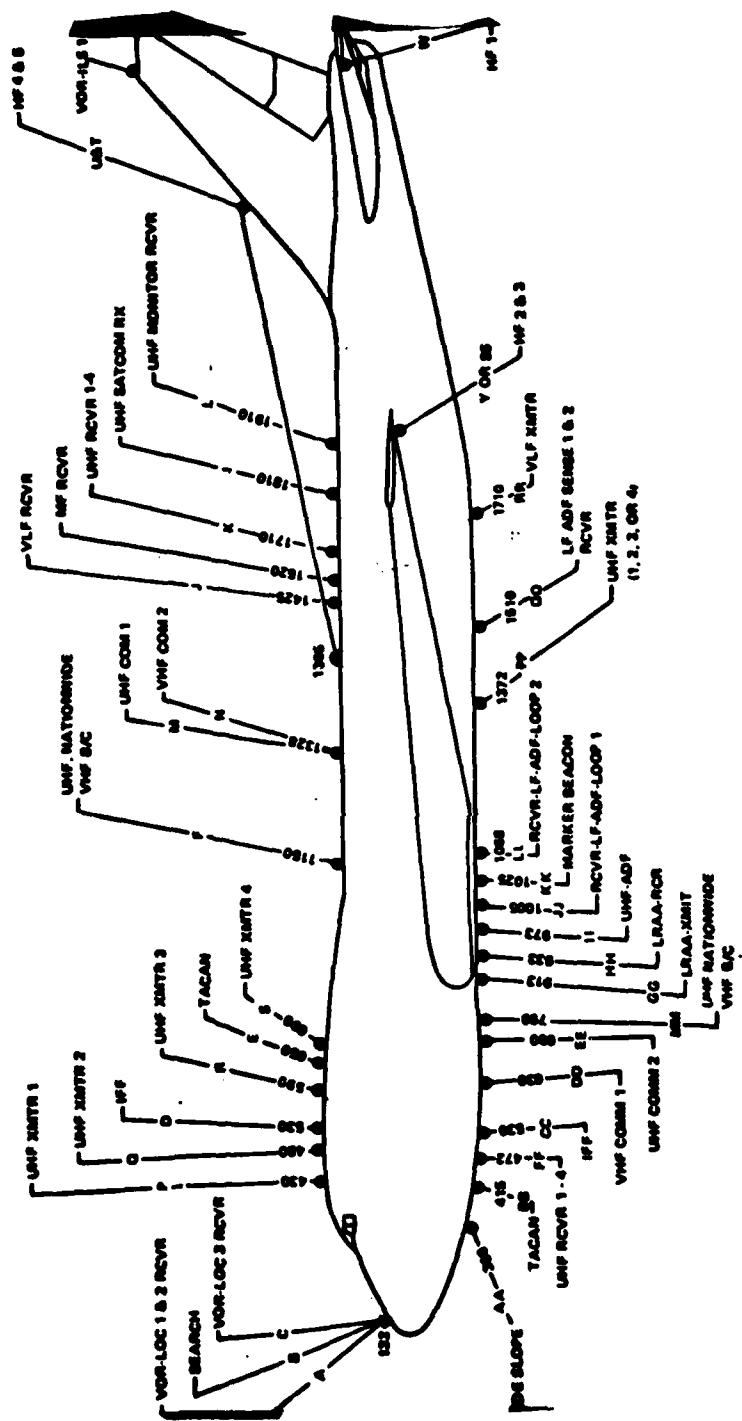
EM IMPACT OF ADVANCED COMPOSITE MATERIALS

IAP TRAINING  
TOTAL OF 195 STUDENTS REPRESENTING

Aerojet Electro Systems Co	General Electric	MMAC
Aeroneutronics Ford	Georgia Institute of Technology	Northrop Corp
Aerospace Corp	Grumman	Pacific Missile Test Center
AFAL	GTE Sylvania	Purdue Univ
AFATL	Harris ESD	RADC
AFCS	Hughes Aircraft	Rand
AFFDL	IBM	Raychem
AFGL	IIT Research Inst	Raytheon
AFLC	IRT Corp	RCA Corporation
AFSC	Israel-Defense Ministry	Rockwell Int'l
AFML	Lockheed	Sachs-Freeman Associates
ALC	Loral Electronic Systems	Samsco
ASD	Martin-Marietta	Sandia Laboratories
Atlantic Research Corp	Mitre	Southwest Research Inst
Bell Northern Research	Motorola	Sperry Univac
Boeing	NADC	Stanford Research Inst
Collins	NASA-Goddard Space Center	Systematics General Corp
Concordia Univ	National Aerospace Lab	Teledyne-Ryan-Aeronautical
Dayton T. Brown Inc	NATC	TRW
Def. Research Est-Ottawa	NAVSEC	USA CEEIA
ECAC	Naval Electronics Lab Center	USA CRDC
ESD	NASC	USA DAVAA-E
Fairchild Space & Electronics	NRL	USAF
General Dynamics	NSWC	US Dept of Commerce
	NUSC	Vought Corp
		Western Electric
		Westinghouse Electric Corp

AGENCIES/  
COMPANIES POSSESSING IAP CODES

Aerojet Elec Systems Co	IBM	IIT Research Inst.	Sylvania
AIL-Cutler Hammer	IRT Corp	Systematics General Corp	Systematics
Atlantic Research Corp	Israel Aircraft Industry	TRW	Vought Corp
Belden Corp	Jet Propulsion Lab	Western Electric	Westinghouse Elec. Corp
Bell Aerospace Textron	Litton	ADTC	
Bell Helicopter	Lockheed	Aerospace	
Boeing	Burbank	AFAL	
Seattle	Marietta	AFFDL	
Wichita	Sunnyvale	AFGL	
British Defense Staff	Loral Electronic Systems	ASD	
Collins Radio	Los Alamos Scientific Lab	Dept. of Commerce	
Cedar Rapids	Magnavox	ECAC	
Newport Beach	Martin Marietta Corp	ESD	
Control Data Corp	McDonnell Douglas	Mitre	
Defense Research Est	St. Louis	Naval	Air Development Center
Fairchild Space & Elec Co	Long Beach	Naval	Air Test Center
General Dynamics	Mitre Corp	Naval	Avionics Facility
Fort Worth	Motorola	Naval	Postgraduate School
Pomona	Northrup	Naval	Research Lab
San Diego	Pacific Missile Test Center	Naval	Weapons Center
General Electric	Packard Electric	Naval	Surface Weapons
Georgia Inst of Technology	Purdue Univ	Naval	
Harris ESD	RCA	USACEEIA	
Hughes Aircraft	R. C. Hansen Inc	USACRDC	
Culver City	Rockwell International		
Los Angeles	Downey		
Grumman Aerospace Corp	Seal Beach		
Auburn University	Sanders Assoc		
E-Systems, Inc	Sandia Laboratories		
Raychem Corporation	Southwest Research Inst		
University of Kentucky	Sperry Univac		



**FIGURE 6-1B. E4-A BASELINE ANTENNA LOCATIONS - CONFIGURATION 2**

TP0/THRUST #/TITLE: 4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY

SUB-THRUST #/TITLE: 4F3 EM COMPATIBILITY

BLOCK TITLE:

IAP/USER/COMPUTER INTERFACE 10

OBJECTIVE:

- DEFINE AREAS WHERE COMPUTER GRAPHICS CAN EFFECTIVELY INCREASE IAP USAGE
- FURTHER DEFINITION & DEVELOPMENT OF THE IAP OUTPUT DATA SYSTEM FILE HANDLER (SFH)
- DEVELOP AN IAP USER HANDBOOK FOR PROGRAM MANAGERS

TECHNICAL APPROACH:

- SURVEY GRAPHICS CAPABILITIES FOR IAP USER DATA VERIFICATION, PLOTTING, STRUCTURE DESCRIPTION, ETC.
- DEVELOP SOFTWARE TO INTERFACE SFH WITH THE USER AND IAP DATA
- DEVELOP GUIDELINES FOR IAP ANALYSIS AND REQUIRED DELIVERABLES.

KEY OFF:

IMPROVE TECHNOLOGY TRANSFER MECHANISM; AND INCREASE RETURN ON INVESTMENT OF EMC ANALYSIS RESOURCES

SUMMARY

- TECHNOLOGY ROADMAP
- IAP ROADMAP
- EMC/IAP SUPPORT CENTER
- KEY PERSONNEL

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